The relationship between childhood adversity and adult psychiatric disorders in offenders

Bowen, Katharine Louise

Awarding institution:
King's College London

Systematic Review and Main Research Project

Katharine Bowen

Department of Psychology
Institute of Psychiatry, Psychology & Neuroscience
King's College London

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Childhood adverse life events and adult psychopathology in adult offenders: a systematic review

Abstract

There is empirical support for an association between childhood adverse events and psychopathology in adult offenders. This systematic review aims to summarise the literature that measures the predictive value of history of abuse on mental illness and personality disorders in prisoners in custody. Thirty studies were identified. The studies examined a total of 11,427 participants (8,990 males, 2,437 females). The number of offenders in each study ranged from 47 to 3,986. Childhood abuse and neglect were primarily examined. There was support that these subtypes are associated with several psychiatric disorders. Additionally, there were differences across male and female offenders both in terms of the numbers of studies that looked at specific psychopathologies, and the associations between adversity and future psychiatric difficulties. Methodological considerations, future research, and clinical implications are discussed.

Introduction

Childhood adverse life events that occurred before the age of 18, can not only cause physical injuries and/or death, but can damage neurobiological and neuroendocrine systems and have been shown to affect behavioural, emotional, social, physical, and cognitive development (Bremner & Vermetten, 2001; Carr, Martins, Stingel, Lemgruber, & Juruena, 2013; Middlebrooks & Audage, 2008; Norman, Byambaa, De, Butchart, Scott, Vos, 2012). Moreover, a growing body of research from animal and human studies suggests that the neurobiological and neuroendocrine damage can be long term, affecting a multitude of brain pathways (Anda, Felitti, Bremner, Walker, Whitfield, Perry, Dube, & Giles, 2006; Shonkoff, Garner, Siegel, Dobbins, Earls, McGuinn, Pascoe, & Wood, 2012).

Community and general population studies have established a strong link between the role of childhood adversity and subsequent mental health difficulties in adulthood (Bagley & Ramsay, 1986; Briere & Runtz, 1988, 1990; Conaway & Hansen, 1989; Fergusso, Boden, & Horwood, 2008; Kilcommons & Morrison, 2005; Malinosky-Rummell & Hansen, 1993; Walsh, Fortier, & DiLillo, 2010). Recent meta-analyses and systematic reviews have evidenced associations between childhood sexual abuse, physical abuse, emotional abuse, and neglect with symptoms of mood, anxiety, psychosis, and personality disorders (Carr, Martins, Stingel, Lemgruber, & Juruena, 2013; Lindert, vonEhrenstein, Grashow, Gal, Braehler, & Weisskopf, 2014; Maniglio, 2010, 2013; Nanni, Uher, & Danese, 2011; Norman et al., 2012; Read, van Os, Morrison, & Ross, 2005; Varese, Smeets, Drukker, Lieverse, Lataster, Viechtbauer, Read, van Os, & Bentall, 2012); however, some meta-analyses have emphasised the complex association of childhood adversity and adult psychiatric difficulties, noting it is ultimately underpinned by both environmental and genetic risk factors (Carr et al., 2013). Furthermore, other review articles have highlighted methodological issues with the studies (Bendall, Jackson, Hulbert, & McGorry, 2008).

Prisoners: an at-risk sample

One population of individuals at risk of being exposed to childhood adversity are offenders. Offending and delinquency is associated with the risk factors of childhood adversity. Compared to their non-criminal peers, juveniles and adults with criminal histories are more likely to come from low-income families (Barnes, 2013; Miller & Barnes, 2013), and have a low IQ (Barnes, 2013; Brewer-Smyth,

2004; Miller & Barnes, 2013; Rappaport & Thomas, 2004). Additionally, poor parent-child relationship, i.e. one characterised by harsh discipline, and coercive interactions, is related to childhood delinquency (Fonagy, 2004; Keijsers, Loeber, Branje, & Meeus, 2011; Rappaport & Thomas, 2004; Scarpa, 2003).

High rates of childhood maltreatment have been observed in offender populations (Abram, Teplin, Charles, Longworth, McClelland, & Dulcan, 2004; Baglivio, Epps, Swartz, Huq, Sheer, & Hardt, 2014; Dierkhising, Ko, Woods-Jaeger, Briggs, Lee, & Pynoos, 2013). In the UK, a report by the Ministry of Justice (2012) indicated that in a sample of approximately 1400 prisoners, 29% reported having experienced childhood sexual, physical or emotional abuse, 41% had witnessed violence as a child, 37% had a family member found guilty of a crime, 27% had a family member with a drug or alcohol problem, and 24% had spent time in care at some point during their childhood. Furthermore, a recent study indicated that the prevalence of adverse childhood experiences (including witnessing domestic violence, experiencing abuse and neglect) in a population of over 64000 American juvenile offenders was higher than previously examined populations, with 50% of the offender population having experience four or more adverse events versus just 13% of college-educated adults (Baglivio et al., 2014).

Offenders populations are not only at an elevated risk for adversity, but also from high rates of neurobiological problems that are associated with the development of psychopathology such as reduced functioning in the prefrontal cortex, amygdala, hippocampus, and anterior cingulate. A deficit in these areas has been linked to problems in social behaviour, emotion processing and emotion regulation (Blair, 2005; Hoptman, 2003; Mitchell & Beech, 2011; Raine, 2002; Wilson & Scarpa, 2012); and has been implicated in the presentation of a range of mental illnesses and personality disorders (Davidson, Pizzagalli, Nitschke, & Putnam, 2002; Garety, Bebbington, Fowler, Freeman, & Kuipers, 2007; Goodman, New, & Siever, 2004; Marcin, Michael, & Nemeroff, 2003; Matcheri, Keshavan, Berger, Zipursky, Wood, & Pantelis, 2005). Unsurprisingly, there is consistent evidence that prisoners have high rates of psychiatric disorders, with estimates of approximately one in seven prisoners diagnosed with psychosis or clinical depression (Fazel, Hayes, Bartellas, Clerici, & Trestman, 2016).

There has been increasing interest in examining outcomes in this at-risk population of offenders. An expanding evidence base has highlighted an association between

exposure to childhood and adolescence maltreatment and subsequent offending behaviours (Farrington, 2000; Dallaire, 2007; Malvaso, Delfabbro, & Day, 2016; Teague, Mazerolle, Legosz, & Sanderson, 2008; Wilson & Stover, 2009), and several studies have observed the impact of childhood adversity on psychopathology in incarcerated offenders. These studies have looked at a range of adverse childhood events, such as childhood sexual abuse and childhood physical abuse, as well as variety of clinical difficulties, for example anxiety, depression, and psychopathy (Borja & Ostrosky, 2013; Fondacaro et al., 1999; Poythress, Skeem, & Lilienfeld, 2006; Wolff & Shi, 2012).

Research addressing the long term psychopathological sequelae of childhood adversity in offenders has many advantages. Firstly, it can improve understanding on the potential consequences of childhood abuse among inmates (Fondacaro, Holt, & Powell, 1999), which can direct inform care provision within prisons and hospitals. Additionally, it is a useful way of defining heterogeneity and understanding the complex association between different subtypes of childhood adversity and psychiatric disorders. It provides hypotheses about the mechanisms behind the relationship between childhood adversity and psychopathology; for example, through social learning, whereby dysfunctional family relationships model to children that anger and aggression are appropriate ways to deal with stressors (Bandura, 1973; Delsol & Margolin, 2004; Wareham, Paquette Boots, Chavez, 2009). Neurobiological findings have extended on this idea and have suggested that child abuse can foster the development of psychopathology in vulnerable individuals through the way it acts on specific regions of the brain (Fallon, 2013; Young & Spatz-Widom, 2014). Finally, gaining a better understanding of these relationships can direct future research in this relatively under-researched area.

To date several studies have been conducted that have examined the relationship between childhood maltreatment and subsequent the subsequent psychiatric impact in adult offenders. To our knowledge, no systematic review has been conducted that examines this topic. Thus, the aim of this review is to examine the relationship between childhood adversity and subsequent adult psychiatric disorders. The study also seeks to identify what aspects of adverse childhood events have been examined as well as what areas of subsequent adult psychiatric disorders have been explored.

Methodology

Search strategy and selection criteria

A search strategy was registered with the International Prospective Register of systematic reviews (Prospero: CRD42016054266). Database searches were conducted using PsychInfo, PsychArticles, Web of Science, and Social Policy and Practice for English-language, peer-reviewed journal articles presenting original data on mental illness and/or personality disorder in adult incarcerated offenders who had experienced childhood maltreatment. There were no limitations regarding publishing date.

Search terms were customised to each database. The search criteria were: “Child* abuse” OR “physical abuse” OR “sexual abuse” OR “psychological abuse” OR “emotional abuse”, “neglect*” OR “trauma*” OR “advers*” OR “maltreat*” OR “bully*” OR “bullied” OR “victim*” OR “expressed emotion” OR “communication deviance” OR “parental loss” OR “separat*” OR “discrimination” AND "mental illness" OR "psychopath*" OR "psychosis" OR "psychotic" OR "PTSD" OR “post-traumatic stress disorder” OR “personality disorder” AND “Adult offend*” NOT (“juvenile offend*” OR “adolescent offend*”). The childhood adversity search terms were based upon those used by Varese and colleagues (2012). Psychopathology search terms were based on pre-existing reviews of community samples that used diagnostic criteria (e.g. Carr et al., 2013; Trotta, Murray, Fisher, 2015).

Inclusion and exclusion criteria

Studies were included in the review if: (i) the study examined the relationship between childhood maltreatment (occurring under the age of 18 years) and an operationalisation of adult mental illness and/or personality disorder (occurring over the age of 18 years); (ii) the participants were prison-incarcerated offenders over the age of 18 years; (iii) the study was a piece of published empirical quantitative research.

Articles were excluded if: (i) there was insufficient information so that the methodology of the study and the results could be extracted; (ii) the paper was a review, case study, qualitative study or discussion article; (iii) the sample consisted exclusively of psychiatric inpatients, i.e. those detained in a forensic hospital or medium secure unit; (iv) the paper was not available in English.

Data extraction and synthesis

Titles and abstracts were reviewed manually, and the full text was retrieved for those papers that met the inclusion criteria or those in which eligibility was not clear. All papers that appeared to meet criteria were reviewed for inclusion and data extraction. Reference lists were checked for additional papers.

The methodological quality of each study was assessed using the Quality Assessment Tool for Quantitative Studies (QATQ; Thomas, Ciliska, Dobbins, & Micucci, 2004). The QATQ rates studies across six general domains: selection bias, study design, confounders, blinding, data collection, and withdrawals. Studies are coded as being methodologically 'strong', 'moderate' or 'weak' across the six domains. A global categorisation based on the rating of the domains is also scored. All the studies were quality assessed by the primary researcher, while a small sample of the studies (n=4) were co-rated by a second researcher to ensure reliability.

A systematic review of assessment tools rated the QATQ as one of the best tools available (Deeks, Dinnes, D'Amico et al., 2003), and it has been used in numerous mental health and violence related studies including individuals who have experienced child maltreatment (Moeller-Saxone, Davis, Stewart, Diaz-Grandos, & Herrman, 2014), measures of domestic violence (Arkins, Begley, & Higgins, 2016), interventions to prevent youth violence (Atienzo, Baxter, & Kaltenthaler, 2017) and mechanisms associated with the onset and maintenance of psychosis (Valmaggia, Day, Rus-Calafell, 2016).

Grouping outcome measures

Across the papers identified several aspects of childhood maltreatment and psychopathologies were used. Most studies used operationalisations of childhood sexual abuse, childhood physical abuse, childhood emotional or psychological abuse, childhood neglect, and a cumulative measure of childhood trauma (cumulative trauma). A low number of studies looked at any other types of trauma. Consequently, studies were evaluated according to childhood sexual abuse, childhood physical abuse, childhood emotional abuse, childhood neglect, other trauma and cumulative trauma. In terms of adult mental illness and personality disorder, a range of disorders were examined across the studies. Disorders were

grouped by common psychiatric terminology (from ICD-10 and DSM-V); anxiety, mood, psychosis, antisocial personality disorder (antisocial PD), borderline personality disorder (borderline PD), and psychopathy. Other personality disorders were examined by a small number of studies, and so a combined 'other PD' grouping was used. Additionally, dissociative experiences were examined by several papers, therefore a separate grouping was used to describe those studies' results.

Results

Study selection

Figure 1 illustrated the selection of relevant studies. The literature search yielded 3250 articles. Removal of duplicates and screening of the title and abstract left 54 studies for full text screening. Twenty-four papers did not meet the eligibility criteria (fourteen papers used a maltreatment variable that included incidents that occurred when the participant was over the age of 18, seven studies did not use a prison-incarcerated population, two papers did not include inferential statistics regarding the maltreatment-psychopathology relationship, and one study had insufficient information about the participants to determine whether the study met eligibility criteria).

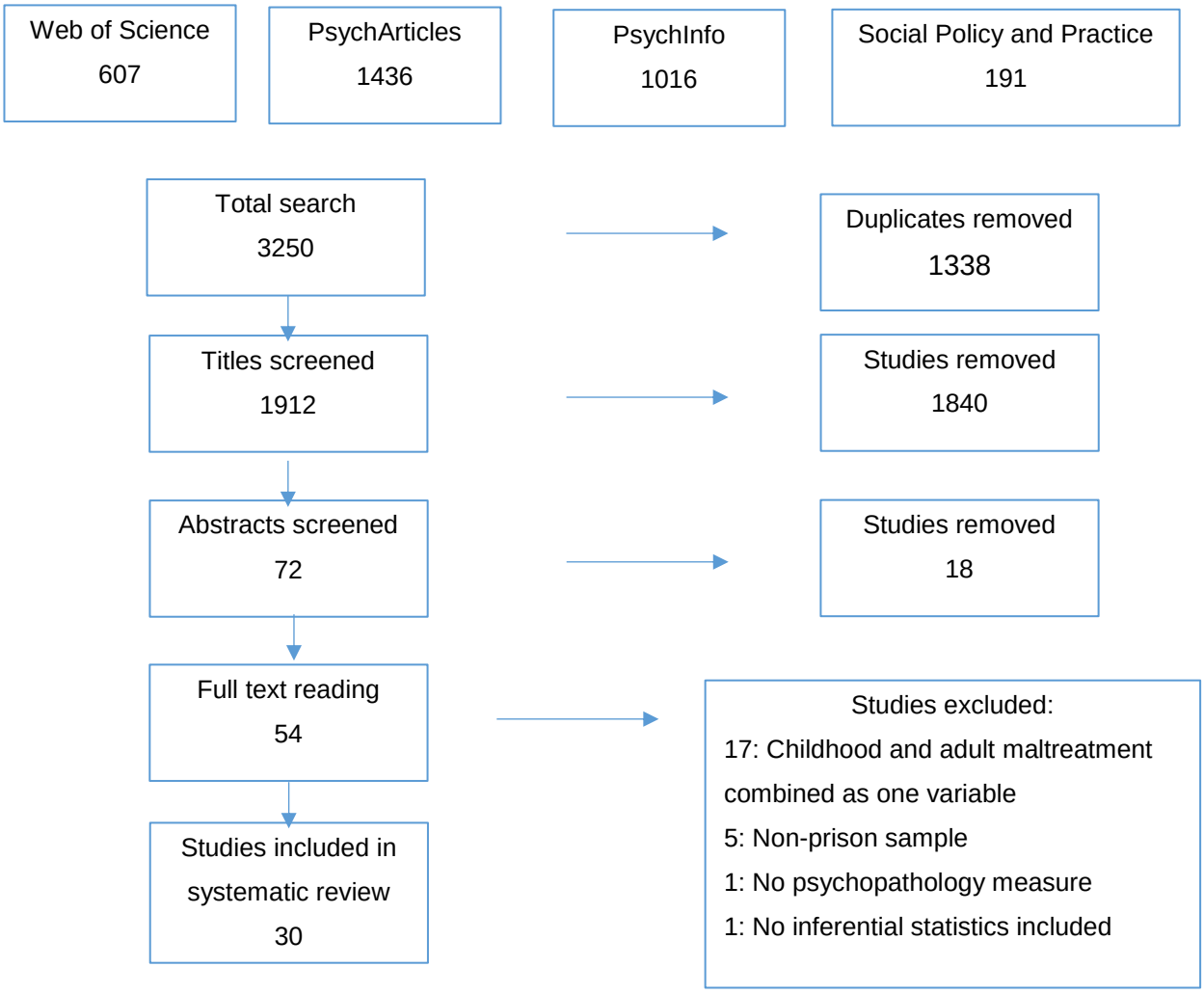

Figure 1. Flowchart of study selection

Sample characteristics

The studies that are included are described in Table 1. The studies examined a total of 11,427 participants (8,990 males, 2,437 females). The number of offenders in each study ranged from 47 to 3,986. Eight studies had sample sizes of less than 100, and two studies had sample sizes of more than 1000 offenders. The studies were undertaken in eleven different countries, with the largest contribution from USA (18 studies), followed by Canada and UK (two studies each). The studies were published between 1996 and 2016, with over two-thirds of the studies taking place in the last ten years. Two studies used a sample of sexual offenders, and one study used a sample of violent, but not sexual offenders. The remaining twenty-seven studies included mixed-offending participants. Thirteen studies focused on male offenders, twelve studies examined females, and five studies had both males and female participants.

Most commonly reported childhood adversity types

Although prevalence rates of childhood sexual abuse tend to be lower than other forms of abuse in both community and forensic populations (Finkelhor, Turner, & Shattuck, 2015; Friestad, Ase-Bente, & Kjelsberg, 2014; Levenson, Willis, & Prescott, 2014; Stoltenborgh, Bakermans-Kranenburg, Alink, & IJzendoorn, 2015), it was the most measured form of adversity in this review. All thirty studies in this review included a measure of it either alone or as a combined trauma variable. Childhood physical abuse was also examined in a high number of studies; twenty-six studies included it in their data analyses. Cumulative trauma, an aggregate measure of multiple types of trauma was also examined by two thirds of the studies. Cumulative trauma had a range of meanings across the studies including presence of more than one type of trauma (Akyuz et al., 2007; Chen & Gueta, 2015; Cima et al., 2008; Graham et al., 2012; Greene et al., 2014; Loper et al., 2008; Poythress et al, 2006; Saavedra & Alvarez, 2013; Schimmenti et al., 2015), childhood physical and sexual abuse (Graham, 1996; Kennedy et al., 2013; Kennedy et al., 2016; Tripodi & Pettus-Davis, 2013; Zlotnick, 1997; 1997) number of childhood traumas (Greene et al., 2014), and severity of childhood trauma (Driessen et al., 2006).

Childhood emotional abuse, neglect, and other forms of adversity were examined substantially less than physical, sexual and cumulative abuse. Emotional abuse was measured by fourteen studies, and neglect was examined by eleven studies. Less than half of the studies in this review looked at variables other than childhood

abuse and neglect. In the small number of studies that considered other types of adversity, parental difficulties (conflict/domestic violence, criminality, mental health and parental separation) and loss (traumatic loss or being removed from birth family) were looked at mostly. Considering that peer relationships have been shown to influence delinquent behaviour (Watts & McNulty, 2014) as well as psychopathology (Klomek, Sourander, & Elonheimo, 2015), it is surprising that peer relations were only examined in one study (Roberts et al., 2008). Except for cumulative trauma, there were substantially more studies that examined the impact of childhood adversity on adult psychopathology in male offenders than females.

Psychopathology measures

Reflecting the high prevalence of personality disorder and psychopathy observed in prison populations (Fazel & Danesh, 2002), these disorders were measured the most across all the studies in this review, particularly for male offenders. Mood disorders tended to be measure most across female studies. Despite the consistent findings in community studies that traumatic life events are robust risk factors for the development of psychosis (Bendall, Alvarez-Jimenez, Nelson, & McGory, 2013; Gibson, Alloy, & Ellman, 2016; Vaerse et al., 2012), and the evidence that cumulative childhood trauma predicts PTSD symptom complexity in adults (Cloitre, Stolbach, Hermn, ven der Kolk, Pynoos, Wang, & Petkova, 2009) psychosis and PTSD were the least examined adult psychopathology outcomes across the papers included in this review.

Table 1. Characteristics of studies identified by review

Study	Year	Country	Final sample	Mean age (SD, range)	Offender type	Child maltreatment measure	Psychopathology measure	Main findings	Quality assessment rating
Akyüz *et al.*	2007	Turkey	108, all males	36.4 (12.5, 19-68)	Mixed offending, maximum security	Childhood Abuse and Neglect Questionnaire (CANQ)	Dissociative Experiences Scale (DES)	Dissociation significantly related to CSA, not CN, CEA, CPA or CT Trauma frequency: CPA=34.3%, CN=22.2%, CEA=16.7%, CSA=3.7%	Moderate
Borja & Ostrosky	2013	Mexico	194, all males	Low= 38.7(10.6), medium= 32.3 (9.1), high psychopathy = 32.6 (8.6)	Mixed offending, maximum security	Early Trauma Inventory Short Form (ETI)	Psychopathy Checklist-Revised (PCL-R)	High psychopathy positively related to CT. Psychopathy also related to CPA, CEA, CSA, domestic violence, death of peer, illness/hospitalisation, and accidents/injuries Trauma frequency for whole sample not provided	Weak
Chen and Gueta	2015	Israel	50, all females	35 (10.5)	Mixed offending, maximum security prison	Childhood Trauma Questionnaire (CTQ)	Beck Depression Inventory-II	CT, CSA, CPA, CEA, CN not associated with depression or psychiatric illness Trauma frequency: CEA=72%, CPA=62%, CN=60%, CSA=54%	Moderate
Cima *et al.*	2008	The Netherlands	47 prisoners, 27 UGs, all males	Prisoners 30.4 (9.72), UG 24.9 (8.56) – age controlled	Healthy undergraduate control Mixed offending, prison	CTQ	Psychopathic Personality Inventory (PPI)	Psychopathic offenders report less physical neglect than non-psychopathic offenders. No differences for CEA, CSA, CPA or emotional neglect Trauma frequency not reported	Moderate
Dietrich	2003	Canada	93, 62 males and 31 females	34 (9.5)	Mixed offending, correctional facility	Child Maltreatment Interview Schedule Short Form	Detailed Assessment of Posttraumatic States (DAPS) Multiscale Dissociation Inventory (MDI) Somatoform Dissociation Questionnaire (SDQ-20)	CEA associated with PTSD and two aspects of dissociation. Maternal emotional neglect associated with one aspect of dissociation. CSA (without penetration) associated with one aspect of dissociation. CSA (with penetration) associated with four aspects of dissociation and total dissociation. CPA, domestic violence, and paternal emotional neglect not associated with PTSD or dissociation Trauma frequency: CEA=69.9%, CSA (without penetration)=65.6%, CPA=64.5%, domestic violence=60.2%, CSA (with penetration)=59.1%,	Moderate

								paternal emotional neglect=45.2%, loss of parent=28%, maternal emotional neglect=22.6%	
Driessen *et al.*	2006	Germany	139, 76 males and 63 females	34 (9.8)	Mixed offending, prison	CTQ	Structured Clinical Interviews for DSM-IV Axis I and II disorder (SCID-I and II) Global Assessment of Functioning Scale General Severity Scale	CT associated with current Axis I disorders, number of current and lifetime Axis I disorders, lifetime and current anxiety disorders, PTSD, PDs, number of PDs, Cluster B PDs, BPD, ASPD, and Cluster C PDs. No association between CT and psychosis, affective disorders, or Cluster A PDs Trauma frequency: severe emotional neglect=33.1%, severe CPA=23.7%, severe CEA=23.7%, severe CSA=9.4%, severe physical neglect=5.0%	Moderate
Fondacaro and Holt	1999	USA	211, all males	32 (18-63)	Mixed offending, jail and prison	Self-report	Diagnostic Interview Schedule Version III-R	CSA related to lifetime schizoaffective disorder, lifetime and current depression, lifetime and current PTSD, lifetime panic disorder, lifetime generalised anxiety disorder, lifetime obsessive compulsive disorder, and ASPD. CSA not related to schizophrenia, bipolar or dysthymia Trauma frequency: CSA=40.4%	Moderate
Graham	1996	Canada	286, all males	Not given	Sex offenders, minimum security	Self-report	DES Minnesota Multiphasic Personality Inventory (MMPI)	Both CPA and CSA, and CSA groups report more alienation than no abuse. CPA by both parents have higher level of dissociation than those abused by father or mother alone Trauma frequency: CSA=70%, CPA=50%	Weak
Graham *et al.*	2012	USA	226, all males	42.08 (11.14)	Sex offenders, unclear location	Review of case files	PCL-R	CSA associated with higher PCL-R total and interpersonal, lifestyle and behavioural facets. CPA associated with behavioural facet. CN associated with behavioural facet. CT related to PCL-R total. CEA not associated with psychopathy. Trauma frequency: CSA=41.7%, CPA=33.6%, CEA=17%, CN=9%	Moderate
Greene *et al.*	2014	USA	465, 284 males and 181 females	31.7 (9.3)	Mixed offending, jail	Traumatic Events Screening Instruments (TESI)	SCID-I Clinician Administered Post Traumatic Disorder Scale (CAPS)	Axis I disorders associated with CT, CPA and CSA. All relationships fully mediated by post-traumatic stress symptoms. CEA and traumatic loss not related to Axis I disorders Trauma frequency: CPA=33.6%, CSA=21.2%, traumatic loss=19.8%, CEA=4.5%	Moderate
Hicks *et al.*	2010	USA	226, all females	31.9 (6.8)	Mixed offending, prison	Life Events Checklist	PCL-R	Psychopathy related to CPA, CSA, and CT. Higher proportion of secondary psychopaths experience CPA than controls. Higher proportion of primary psychopaths experienced CSA than control prisoners Trauma frequency not provided	Moderate
Hill and Nathan	2008	UK	54, all males	29.16 (5.74)	Violent, not sexual, offenders, prison	Childhood Experiences of Care and Abuse	SCID-II	ASPD associated with parental tension, not CSA, CPA, CN, or domestic violence. Conduct disorder mediates ASPD-parental tension relationship Trauma frequency: CPA=65%, parent tension=43%, domestic violence=28%, CN=24%, CSA=15%	Moderate

Jenks	2010	USA	78, all females	36.5 (11.04, 20-62)	Mixed offending, correctional facility	CTQ	Personality Assessment Inventory (PAI)	CSA related to anxiety, but not depression, ASPD or BPD Trauma frequency: CSA=53.8%	Strong
Kennedy *et al.*	2016	USA	230, all females	33.7 (9.9, 18-72)	Mixed offending, maximum, medium and minimum security prisons	CTQ	Mini International Neuropsychiatric Interview (MINI)	CPA related to current psychosis, but not depression. CSA related to current depression and psychosis. CPA and CSA related to current depression and psychosis. Trauma frequency: CPA and CSA=29.5%, CSA=16.5%, CPA=9.8%	Strong
Kennedy *et al.*	2013	USA	159, all females	33.7 (9.71, 18-62)	Mixed offending, maximum, medium and minimum security prisons	CTQ	MINI	CPA and CSA severity related to psychosis. CPA severity and CSA severity alone not related to psychosis Trauma frequency: CPA and CSA=37%, CPA=16.2%, CSA=11.3%	Strong
Kimonis *et al.*	2010	USA	266, all females		Mixed offending, prison or drug treatment facility	Child Abuse and Trauma Scale (CATS)	PAI PCL-R	CSA associated with anxiety, depression, ASPD, PCL-R total and PCL-R lifestyle. CPA associated with anxiety, depression, ASPD, and PCL-R lifestyle. CEA associated with anxiety, depression, ASPD, PCL-R total and PCL-R lifestyle. CT associated with anxiety, depression, ASPD, PCL-R total, and PCL-R lifestyle Trauma frequency not reported	Moderate
Loper *et al.*	2008	USA	142, all females	Cluster B 30.03 (7.78), non-Cluster B 33.03 (8.29)	Mixed offending, high security prison	Physical Maltreatment Scale, Psychological Maltreatment Scale, Sexual Maltreatment Scale (adapted from Sexual Experiences Questionnaire)	SCID-II	Cluster B offenders have significantly higher reported levels of maternal and paternal maltreatment, but not CSA Trauma frequency: verbal maternal maltreatment=92.3%, physical maternal maltreatment=77.5%, verbal paternal maltreatment=89.1%, physical paternal maltreatment=67.4%, CSA with penetration=29.6%	Moderate

Poythress *et al.*	2006	USA	615, all males	30.5 (6.2)	Mixed offending, prison or drug treatment facility	CATS	PAI PPI PCL-R	CT associated with dissociation, PCLR-total and PCL-R lifestyle facet. CPA associated with lifestyle PCL-R only. CEA associated with one aspect of dissociation and lifestyle PCL-R. CSA associated with two aspects of dissociation Trauma frequency not provided	Moderate
Roberts *et al.*	2008	UK	1396, all males		Mixed offending, prison	Self-report	SCID I and II	CSA associated with histrionic PD and BPD. CEA associated with obsessive-compulsive and schizoid PD. CN associated with avoidant, obsessive-compulsive PD. Emotional neglect associated with paranoid PD and ASPD. Family mental health associated with histrionic PD. Harsh discipline associated with ASPD. Family criminality associated with avoidant PD and ASPD. Parental discord associated with ASPD. LAC associated with BPD and ASPD. Criminal peers associated with ASPD. Being bullied associated with avoidant, histrionic PD and BPD Trauma frequency: harsh discipline=77.7%, criminal peers=70.9%, parental discord=61.7%, criminal family=55.3%, LAC=32.2%, emotional neglect=27.3%, bullied=26.7%, family mental health problems=19.8%, CEA=17.6%, CN=12.2%, CSA=6.8%	Moderate
Roe-Sepowitz *et al.*	2007	USA	192, all females	35.7 (9.46)	Mixed offending, correctional facility	Child Maltreatment Interview Schedule Trauma Symptom Inventory	Trauma Symptom Inventory (TSI)	Dissociation related to CSA and CPA, but not CEA or domestic violence. Only CPA predictive of dissociation Trauma frequency: CSA with penetration=72%, CSA without penetration=68%, domestic violence=57%, CPA=50%, CEA=27%	Moderate
Saavedra and Alvarez	2013	Spain	472, all males	37.15 (10.3, 18-76)	Mixed offending, prison	Self-report	SCID-I	CT associated with psychosis and drug-related psychosis, but not depression or anxiety Trauma frequency: witnessing violence=40.5%, serious accident=40.5%, CN=9.5%, CSA=4.8%, CSA and CPA=4.8%	Strong
Saxon *et al.*	2001	USA	129, 124 males and 5 females		Mixed offending, jail	Life Event History Questionnaire	PTSD Checklist-CV (PCL-CV)	CPA more likely to screen positive for PTSD than no PTSD. CT more likely to screen positive for PTSD than no PTSD. No difference for CN. Trauma frequency: CPA=29.7%, CN=28.9%	Moderate
Schimmenti *et al.*	2015	Italy	78, all males	43.3 (10.9, 20-71)	Mixed offending, prison	Traumatic Experiences Checklist	PCL-R	CEA associated with PCL-R total, PCL-R Factor 1, PCL-R Factor 2. CEA was the only unique predictor of psychopathy. CPA associated with PCL-R Factor 2. CSA associated with PCL-R Factor 2. Trauma frequency: CEA=51.3%, CPA=46.2%, CSA=21.8%	Moderate

Tripodi and Pettus-Davis	2013	USA	125, all females	34.3 (9.94, 19-62)	Mixed offending, maximum, medium and minimum security prisons	CTQ National Violence Against Women Survey Experiences of Sexual Victimisation	Addiction Severity Index	CPA and CSA together related to psychiatric illness. CPA and CSA alone not related to psychiatric illness Trauma frequency: CPA and CSA=32.5%, CPA=20.3%, CSA=11.4%	Strong
Verona *et al.*	2005	USA	226, all females	31.9 (6.8)	Mixed offending, correctional facility	Self-report	PCL-R	CSA associated with PCL-R total and Factor 2. CPA associated with PCL-R total and Factor 2 Trauma frequency: CSA=33.6%, CPA=27.4%	Moderate
Viitanen *et al.*	2011	Finland	410, 307 males and 103 females	34.1 (10.4) males 34.6 (10.0) males	Mixed offending, prison	Self-report	SCID-I and II Clinical medical examination ICD-10 diagnoses	Men: CPA associated with BPD, mood and anxiety, but not ASPD. CSA associated with mood disorder, but not BPD, ASPD or anxiety. Parents separated associated with ASPD, not BPD, anxiety or mood disorder Women: CPA associated with BPD, but not ASPD, mood or anxiety disorders. CSA associated with BPD and ASPD, but not mood or anxiety disorders. Parents separated not associated with BPD, ASPD, mood or anxiety Trauma frequency men: parents separated=63.2%%, CPA=14.9%, CSA=7.4% Trauma frequency women: parents separated=63.4%%, CPA=24.8%, CSA=31.7%	Strong
Wolff and Shi	2012	USA	3986, all males	33.3 (10.1)	Mixed offending, maximum, medium, and minimum security	Self-report	Self-report	CPA associated with depression and anxiety treatment. CSA associated with depression treatment and symptoms, and anxiety treatment and symptoms. Being abandoned associated with depression treatment and symptoms, and anxiety symptoms Trauma frequency: CPA=44.7%, CSA=10.9%, CPA and CSA=9.6%	Weak
Zgoba *et al.*	2013	USA	654, all males	56.85 (5.99, 50-82)	Mixed offending, prison	Life Stressors Checklist-Revised	PCL-CV	PTSD related to CSA with and without penetration Trauma frequency: CSA (without penetration)=21.6%, CSA (with penetration)=17.6%	Moderate
Zlotnick	1997	USA	85, all females	31 (8.6)	Mixed offending, prison	Clinician Administered Assessment Interview for Adults	SCID-I and II SIDES	CT significantly related to PTSD Trauma frequency: CT=65.9%	Moderate

Zlotnick	1999	USA	85, all females	31 (8.6)	Mixed offending, prison	Clinician Administered Assessment Interview for Adults	SCID I and II SIDES	CT significantly related to BPD, but not ASPD Trauma frequency: CT=65.9%	Strong

ASPD=antisocial personality disorder; BPD=borderline personality disorder; CSA=childhood sexual abuse; CPA=childhood physical abuse; CEA=childhood emotional abuse; CN=childhood neglect; CT=cumulative trauma; LAC=local authority care; PD=personality disorder; PTSD=post-traumatic stress disorder

The relationship between childhood adversity and adult psychiatric disorders in offenders

The review aimed to examine the relationship between childhood adversity and subsequent adult psychiatric disorders, to identify what aspects of adverse childhood events and subsequent adult psychiatric disorders have been examined, and to assess the methodological rigour of the studies included in the review. Thirty studies were identified that examined the relationship between childhood adversity and adult psychopathology in prison-incarcerated offenders. In line with the research within community settings (Carr et al., 2013), most of the papers selected for this review confirmed an association between childhood traumas and the presence, number or severity of adult psychiatric disorders.

Gender differences

There was considerable variation in terms of the adult psychopathology outcomes of male offenders, although largely a history of trauma or neglect was consistently related to mental illness rather than personality disorders. Childhood sexual abuse seemed to be consistently linked to mood in the three studies that measured that psychiatric disorder. Also, there was some emerging support for a link between childhood sexual abuse and dissociation, psychosis, Axis I disorders, and feelings of alienation; more consistent evidence is needed in this area. For childhood physical abuse, there was a consistent relationship with anxiety and mood, with possible support for a link with Axis I disorders, borderline PD and psychopathy. There was less consistent support for a definite link between childhood emotional abuse and adult psychopathology; there was some evidence of a link with anxiety and axis I disorders, but only one study looked at those variables. Childhood neglect was consistently related to psychopathy across the two studies that looked at that relationship. For cumulative trauma, there was a relationship with Axis I disorders. All other variables indicated either inconsistent results across studies, or only one study explored that relationship (i.e. borderline PD, antisocial PD, alienation).

In terms of other childhood adversities, there was tentative support for parental difficulties being related to typically antisocial PD in male offenders. Parent substance use seems to be related to anxiety (Dietrich, 2003) and antisocial PD (Roberts et al., 2008), but not other PDs (Roberts et al., 2008) nor dissociation (Dietrich, 2003). Parent and family mental illness was related to psychosis

(Saavedra & Alvarez, 2013) and histrionic PD (Roberts et al., 2008), but not other PDs. One study found support for a relationship between parental criminality and Avoidant PD and antisocial PD, but not any other PD (Roberts et al., 2008). Parental discord, tension or violence was related to antisocial PD (Hill & Nathan, 2008; Roberts et al., 2008) and psychopathy (Borja & Ostrosky, 2013), but not other PDs (Roberts et al., 2008), nor anxiety, nor dissociation (Dietrich, 2003). Coming from a 'broken family' was related to antisocial PD but not borderline PD nor mood (Viitanen et al., 2011).

In terms of loss, whilst traumatic loss showed no relationship with Axis I disorders (Green et al., 2014), experiencing the death of a friend was associated with future psychopathy (Borja & Ostrosky, 2013). Going into Local Authority Care was demonstrated to have a positive relationship with borderline PD and antisocial PD, but no other PD (Roberts et al., 2008). Being abandoned as a child was also linked to adult anxiety and depression (Wolff & Shi, 2012). Peer relationships seemed to have an impact on the development of PD in Roberts and colleagues' study, which found that being bullied was positively related to borderline PD, Histrionic and Avoidant PD (but no other PDs), and peer criminality was positively related to subsequent antisocial PD development (but no other PDs). The same study also found that harsh discipline was related to antisocial PD development too. In sum, it appears there is an emerging evidence base to suggest that other traumas may play a factor in subsequent psychiatric problems, but that this is a very under-researched area.

For females, there seemed to be a consistent relationship between childhood adversity and disorders that are implicated in the presentation of blunted emotions; dissociation and psychopathy. Childhood sexual abuse, childhood physical abuse, childhood emotional abuse and childhood neglect were constantly related to dissociation, whilst childhood sexual abuse, childhood physical abuse, childhood emotional abuse, and cumulative trauma were reliably related to psychopathy. However, there was also consistent evidence for childhood emotional abuse being related to anxiety and antisocial PD, and cumulative trauma being related to anxiety, Axis I disorders, and borderline PD, highlighting that emotional blunting is not the sole difficulty that females are prone to following a history of maltreatment. Only four papers looked at other trauma types in female offenders, which included: the impact of a broken family on borderline PD, antisocial PD, mood, and anxiety (Viitanen et al., 2001); the impact of witnessing parental violence and physical

abuse on dissociation and PTSD (Dietrich 2003); the impact of parental substance problems on dissociation and PTSD and dissociation (Dietrich 2003; Roe-Sepowitz et al., 2007); and the impact of traumatic loss on number of current Axis I disorders (Greene et al., 2014). There was no indication of support for any links between other types of trauma and psychopathology in female offenders; however due to the small number of studies, and because two studies used mostly male participants, more research is needed.

There was substantial variation in adversity-psychopathology relationships amongst the studies, which could be due to several reasons. Firstly, it could reflect the complex association of childhood adversity and adult psychiatric difficulties. There are numerous environmental and genetic risk factors for psychopathology in adulthood (Carr et al., 2013), and the participants in these studies may have several personality or genetic characteristics, or have been exposed to a wide range of adversities that have not been controlled for or examined. Indeed, a small number of studies looked at mediating and moderating variables in the abuse-psychopathology relationship, and noted that abuse alone may not lead to future psychopathology; post-traumatic stress symptoms (Greene et al., 2014) and family mental health problems (Chen & Guetta, 2015) have a strong role in the pathway. The variation may also be due to other methodological issues, such as low numbers of studies or measurement biases that will be discussed below. However, the findings of this systematic review should be considered as emerging evidence and warrant further research.

Limitations

Publication bias

There are several methodological limitations of this systematic review. As Norman and colleagues (2012) noted, reviews can be subject to publication bias because non-significant findings are less likely to be published. The findings of this review may therefore over represent the relationship between childhood adversity and adult psychopathology in offenders.

Measurement issues

There were inconsistencies in how categories of maltreatment were defined and measured across the studies. Although there were five main types of adversity that were measured (childhood sexual abuse, childhood physical abuse, childhood

emotional abuse, childhood neglect, cumulative trauma), there were eighteen different trauma measures used across the thirty studies that had varying definitions of abuse. Similarly, there were nineteen different measures of psychopathology. While many studies used validated measures of trauma, seven included self-report measures of abuse. Without psychometric evaluation of a measure it is unclear whether the intended construct has been accurately assessed, making any findings hard to interpret. There were also difficulties with the validated measures of abuse. For example, the Life Experiences Questionnaire assesses actual physical contact within their sexual abuse measure, while the CTQ includes "someone threatened to hurt me or tell lies about me unless I did something sexual with them" within the category. In some studies, abuse was recorded only if a family member was the perpetrator whilst in other studies any person could be the abuser. Additionally, while both childhood sexual abuse and childhood neglect were measured as one variable in most studies, a small number of studies looked at separate variables of emotional neglect, physical neglect, penetration, and other sexual acts. These variations in measurement make comparisons between studies problematic. Also, because some studies only consider abuse when it was perpetrated by a family member, there is likely to be an under-reporting of abuse (i.e. from those individuals who were abused by other people). The difficulty of defining and measuring child abuse has been described in other studies (Browne, Miller, & Maguin, 1999; Cicchetti, 1989; Finkelhor, 1994; Loper et al., 2008; Mash, & Wolfe, 1991; Norman et al., 2012).

Study design

All the studies included retrospective reports of abuse, and many used self-report measures of trauma and psychopathology. As outlined by Briere (1992), this can cause difficulties. Due to the retrospective (and for many studies, correlational) character of the studies it can be hard to determine cause and effect. While it could be assumed that the childhood abuse predates adult psychopathology, current distress/symptomology may impact on the respondent's retrospective reports of abuse, for example some individuals can block out painful memories and become amnesic for much the abuse they have endured. However, as Bendall and colleagues (2008) note, a prospective study of childhood abuse would be an ethical challenge because the detection of child abuse would require it being reported, which would change the natural trajectory of abuse and its sequelae.

While most studies controlled for a range of socio-demographic and study design variables, a few studies presented unadjusted associations between child maltreatment and health outcomes, or adjusted for age and sex only. Furthermore, while a small number of papers looked at the role of moderators and mediators in the relationship between childhood abuse and adult psychopathology (Greene et al., 2014), most did not. Previous research in community populations has highlighted several important factors that seem to be related to better or worse adaptation to childhood adversity. These factors include self-esteem, locus of control, attributions of blame, peer relationships, and coping strategies (Cicchetti, Rogosch, Lynch, & Holt, 1993; Lynskey & Fergusson, 1997; McGee, Wolfe, & OIson, 2001). Going forward, it is imperative for future studies to ensure that confounders and co-variables are adequately and appropriately considered in offender models.

A final design limitation of some of the studies involved potential selection bias. Recruitment procedures were not always sufficiently described, which limited assessment of the representativeness of the prison sample. Moreover, when prisoners declined to participate it was reportedly challenging to document differences between the samples because refusers declined to be interviewed.

Future directions for research

The review highlights the current focus on a small range of adversity and psychopathology variables. Primarily childhood abuses were examined in this offender population, with very few studies looking at any other type of adversity or neglect. There is evidence from community samples that both problematic parental relationships and bullying during childhood are associated with future psychiatric difficulties (Enns, Cox, & Clara, 2002; Sourander, Jensen, Ronning, Niemela, Helenius, Siilanmaki, Kumpulainen, Piha, Tamminen, Moilanen, & Almqvist, 2007). Given that peer and parental relationships are known to be troubled in offending populations (Chambers, Power, Loucks, & Swanson, 2000), it would be useful for other areas of childhood adversity to be examined in this population.

Similarly, psychosis was under-examined compared to the other disorders. For male studies, it was at most examined once (childhood sexual abuse, other trauma, cumulative trauma), and was not examined at all in relation to childhood physical abuse, childhood emotional abuse, or childhood neglect. Although it was looked at more in women, it was not examined at all in relation to childhood emotional abuse,

childhood neglect or other trauma. This may be reflective of a reduced perceived need to examine psychosis in comparison to personality disorders. Antisocial personality disorder has antisocial or criminal behaviour as a primary diagnostic criterion, making it a diagnosis for which most prisoners qualify. Additionally, it could be argued that the prison environment promotes the criteria seen in individuals with antisocial personality disorder, e.g. aggressiveness as indicated by repeated physical fights. Unsurprisingly, a large-scale review study of over 22000 prisoners reported that 3.7% and 4% of male and female prisoners respectively had psychotic illnesses, in comparison to 47% and 21% of males and females with antisocial personality disorder (Fazel & Danesh, 2002). Funding studies that look at the aetiological underpinnings of personality disorders, rather than psychotic illness, may be a bigger priority for justice services. Additionally, the organisational structure of the country's correctional services, i.e. the integration of mental health care, may also play a key role in determining research priorities. The bias of North American studies in this review paper, and the research priorities of those countries, might also have impacted upon the under- and overrepresentation of specific psychopathologies. However, given a link has been established between psychosis and childhood abuse in community populations (Carr et al., 2013; Read et al., 2005; Varese et al., 2012), it would be worthwhile giving this area attention in offending populations who are known to have particularly high rates of psychotic illness (Fazel & Seewald, 2012).

As Kennedy and colleagues (2013; 2016) emphasise, mental health services in prisons are generally not designed to address the prevalent experiences of childhood victimisation. These findings in this review support a demand in the literature for the development of targeted and trauma-focused mental health and transition services for men and women (Drapalski, Youman, Stuewig, & Tangney, 2009; Spjeldnes, Jung, & Yamatani, 2014). Several trauma-informed, gender-responsive, evidence-based interventions are currently being evaluated within the prison context (e.g. Wolff, Huening, Shi, Frueh, Hoover, & McHugo, 2015; Zlotnick, Johnson, & Najavits, 2009). Participation in these interventions has been associated with reductions in mental health issues, as well as decreases in recidivism.

Most of the studies included in this review used samples of mixed-offending participants primarily between 30 and 40 years old from North America or Europe, as such the results can be generalised to that specific population. Exploring this issue in diverse populations (e.g. in different countries, age groups, offending types)

is positive in terms of furthering our understanding of abuse in different contexts. Offenders are a heterogeneous group of individuals, and as such it would be valuable to examine the pathway from childhood adversity to adult psychopathologies within specific subgroups of offenders.

It is also important to highlight that this systematic review specifically examined psychopathology in the context of diagnostic categories. While this approach has demonstrable efficacy (Hoftman & Smits, 2008) and has been widely used in the empirical literature (Carr et al., 2013; Fazel & Danesh, 2002; Trotta et al., 2015), there are also weaknesses. Firstly, there is strong evidence indicating that different psychopathologies have similar aetiological and maintenance processes, and share many similar genetic, familial, and environmental risk factors (Kendler, 1996). Secondly, current and lifetime comorbidity amongst mental disorders is high (Brown, Campbell, Lehamn, Grisham, & Mancill, 2001), particularly among criminal offenders (Ogloff, Lemphers & Dwyer, 2004). Driven by these concerns there is a growing consensus to move away from the single diagnosis approach towards a transdiagnostic conceptualisation of mental disorders (Barlow, Allen, & Choate, 2004; Newby, McKinnon, Kuyken, Gilbody, & Dalgleish, 2015). Poor emotion regulation is one transdiagnostic risk factor that has been implicated in many psychological disorders, including mood, anxiety, eating, substance use, and personality disorders (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Naragon-Gainey, McMahon, & Chacko, 2017). Additionally, there is growing evidence that childhood stressors predict emotion regulation neural functions in adulthood (Kim, Evans, Angstadt, Ho, Sripada, Swain, Liberzon, & Phan, 2013). Going forward, future research may want to consider the impact of childhood adversities on transdiagnostic symptoms generally, and the development of emotion regulation difficulties specifically.

In conclusion, this review of 30 studies found evidence that childhood adversity is associated with a range of psychiatric disorders in adulthood, and that these associations vary across gender. The findings highlight the importance of disruptive experiences early in development on subsequent functioning during adulthood. Most of the studies in this review were published in the last ten years, indicating that this area of study is increasing in interest; however, there are still low numbers of papers in this area, with some disorders not being examined in relation to abuse at all (e.g. childhood emotional abuse and psychosis). Moving forward, future studies should consider looking at the impact of other types of childhood difficulties, as well

as building upon the results of the studies within this systematic review. Given the heterogeneity within this group, it is crucial that sufficient coverage is provided so that adequate inferences can be made and generalised to the wider population. Finally, there is a clear need for psychosocial treatments that address the sequelae of adverse childhood events in this at-risk group. Clinicians should routinely inquire about childhood adversity to develop comprehensive person-centred formulations and treatment plans when working with offenders. Trauma-informed interventions should also be considered among other treatment options when working with this cohort of people.

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Childhood adversity and adult disadvantage predictors of violent offending

Abstract

Childhood maltreatment, mental health difficulties, and substance misuse have all been associated with problem outcomes in adulthood including violent offending. This study aimed to identify the demographic, childhood adversity, adult disadvantage and emerging mental health predictors of violent offending within a large sample of newly convicted young-adult male offenders

Data was based on a screening interview of 2578 male offenders in London prisons. Participants completed questionnaires measuring a history of childhood adversities, measures of mental illness, the Prodromal Questionnaire, and the Cannabis Experience Questionnaire. Childhood adversity exposures included witnessing domestic violence, being bullied, being hit, being seriously injured due to violence by another person, being seriously injured due to oneself, having lived in a children's home, being separated from parents, unwanted sexual contact, and having faced ethnic discrimination. Mental health measures included anxiety, depression, history of self-harm, a history of attempting suicide, and screening positive for psychosis risk. Substance use was recorded for alcohol, weed, 'skunk', stimulants, cocaine, crack cocaine, opioids, and hallucinogens. Adult violence outcomes included being in prison for any crime involving violence towards a person, including sexual offences. All other crimes were classified as non-violent. Using logistic regression analyses and path models, direct and indirect pathways were investigated from childhood maltreatment, mental health difficulties, and adult substance use to adult violence perpetration.

In the final path model, witnessing domestic violence, and monthly stimulant use were both direct predictors of violent offending. Age also directly and inversely predicted violent offending. Screening positive on the prodromal questionnaire and daily alcohol use were both predictive of violent offending, but only when mediated by monthly stimulant use.

The data suggests that individuals who violently offend require intervention and support for psychosis risk, stimulant and alcohol use. Moreover, there are also implications for targeting those who have witnessed domestic violence.

Introduction

In forensic research, offending has typically been classified according to its severity, development, and timing in the life course (Henry, Caspi, Moffitt, & Silva, 1996; Loeber, & Farrington, 1998; Moffitt, 2003, Stattin & Magnusson, 1996); however, research on the correlates of crimes infrequently distinguishes between violent and non-violent crime types (Elonheimo, Sourander, Niemela, & Helenius, 2011; Loeber, Farrington, Stouthamer-Loeber, 2003). While there is a need to understand general risk factors for offending, it is essential to differentiate between risk factors associated with violent and non-violent offending so that targeted interventions can be developed and implemented.

The relationship between risk factors and criminal behaviour is complex. Not only are offenders a heterogeneous group, but also risk factors often interact with each other making it complicated to define which have the largest effect on offending (Dodge and Pettit, 2003). Numerous studies have indicated that violence is primarily associated with family and individual factors from early on in life, such as having a serious mental illness, having substance use problems, and being exposed to certain childhood traumas. In comparison, environmental influences seem to play a key role in non-violent crime (Moffitt, 2003; Moffitt, Caspi, Dickson, et al., 1996; Stattin & Magnusson, 1996). Several key factors associated with violent crime are briefly described below.

Age

One key demographic factor related to violence is age. Crime, including violent offending, is robustly related to age, rapidly peaking in the late teen years/early adulthood and declining thereafter (Loeber & Farrington, 2014; Marcus, 2009; Sweeten, Piquero & Steinberg, 2013). Indeed, a recent study of over 4600 young adult males indicated that violent men were significantly younger than non-violent males (Coid, Ullrich, Keers, Bebbington, DeStavola, Kallis, Yang, Reiss, Jenkins, & Donnelly, 2013). There are several explanations for this pattern: changes during early adulthood to the frontal lobes that underlie behavioural self-regulation (Steinberg, 2005) may be one factor and the gradual achievement of goals in early adulthood (e.g. relationships, qualifications, employment) may lead to avoidance of behaviours that risk jeopardising those goals (Marcus, 2009).

Substance use

Substance use is highly prevalent in prison populations, with estimates of up to 60% (Fazel, Bains, & Doll, 2006), and is a key predictor of both violent and nonviolent offending. Specific types of substance use, such as alcohol (McKetin, Lubman, Najman, Dawe, Butterworth & Baker, 2014; Young, Wells & Gudjonsson, 2011) and stimulants (McKetin et al., 2014) seem to be associated with violence. Alcohol has been cited frequently as a factor in aggression and violence, affecting behaviour through intoxication, and long-term personality changes (Boles & Miotto, 2003). Despite its legal status in comparison to other drugs, alcohol causes the most harm to others, and is the third most harmful drug to society in terms of crime (Nutt, King, & Phillips, 2010). Not only does alcohol intoxication decrease the capacity to plan actions in response to threatening situations, chronic alcoholism can increase the propensity to blame others (Lavine, 1997). Moreover, alcohol can trigger some individuals to act aggressively; several studies have suggested that people who have a general tendency to be aggressive are more likely to show elevated levels of aggression when they consume alcohol compared to those who do not drink (Bailey & Taylor, 1991; Zhang, Wieczorek, & Welte, 1997). However, not all individuals who drink alcohol behave aggressively, indicating the relationship with violence is not straightforward. Additionally, recent evidence has suggested that after adolescence other drug use may play a more significant role in the initiation of serious violent offending during adulthood (White, Buckman, Pardini, Loeber, 2015), and that heavy alcohol consumption together with methamphetamine use increased the risk of violence in young adults (Baskin-Sommers & Sommers, 2006; McKetin et al., 2014).

Stimulants such as amphetamines and methamphetamines have been shown to influence violent behaviour (Boles & Miotto, 2003), with chronic use more closely related to violent behaviour than any other psychoactive drugs (Kosten & Singha, 1999). Both chronic and acute administration can cause behavioural changes, including irritability, aggression, hyperawareness, hypervigilance, sleep deprivation, and psychomotor agitation (Kosten & Singha, 1999). Chronic use can produce a psychotic paranoid state and stimulant-induced psychosis, including paranoia and delusions that can result in aggression (Kosten & Singha, 1999; Miczek & Tidey, 1989). Moreover, drug-induced psychosis is brought on more commonly by amphetamines than by any other stimulants (Boles & Miotto, 2003).

Other stimulants, such as cocaine and crack cocaine have also been linked to the perpetration of crime and violence. Like amphetamines, they are associated with irritability and physical aggression, and can produce violent outbursts, particularly in individuals with a pre-existing psychosis (Roth, 1994), although unlike amphetamines their effect duration tends to be substantially briefer. In addition to heroin, crack cocaine and cocaine are the three drugs most commonly associated with crime (Bennett, Holloway, & Farrington, 2008); however, data has mainly focused on non-violent crime, such as property crime, theft, and shoplifting. For example, for property crime, odds ratios have been as high as 11.5 for cocaine and 20.2 for crack cocaine.

There has been mixed evidence for the impact of cannabis on violence. Cannabis has a range of effects on mood including euphoria, relaxation, perceptual alterations, anxiety, and paranoia (Gold & Tullis, 1999). Historically, research has suggested that cannabis acts as a depressant and in moderate doses temporarily inhibit violent behaviour (Reiss & Roth, 1993), and in high doses has psychoactive effects that are not necessarily linked to aggression (Gold & Tulllis, 1999). Moreover, there has been some evidence that cannabis is used as a means of self-medication for problems controlling aggression (Arendt, Rosenberg, Fjordback, Brandholdt, Foldager, Sher & Munk-Jorgensen, 2007), as well as low mood, anxiety, and pain (Ashton, Moore, Gallagher & Young, 2005; Croxford, 2003; Carhart-Harris & Nutt, 2010). However, recent research has found a dose-response relationship between cannabis use and violent behaviour (Schoeler, Theobald, Pingault, Farrington, Jennings, Piquero, Coid, & Bhattacharyya, 2016). One possible mechanism for this is through response inhibition and impulsivity (Bhattacharyya et al., 2014, 2015); tetrahydrocannabinol (THC) has been shown to certain forms of impulsive behaviour (McDonald, Shleifer, Richards, & de Wit, 2003). Skunk-type cannabis, which is more potent than hash/weed-type and contains more THC (Di Forti, Marconi, Carra, et al., 2015), has been increasing in use dramatically over recent years. Seizures of cannabis around England in 2008 by police indicated that skunk had a market share of over 70% (Hardwick & King, 2008). Although there is limited research that has examined the impact of skunk on violent crime, the risk for violence might be greater for those who use skunk versus those who use less potent forms of cannabis.

There is limited evidence for a direct relationship between other depressants, such as opioids and violence. Opioids tend to depress activity and inhibit violent

behaviour; although some evidence suggests that during withdrawal individuals can experience agitation, aggression, anxiety and irritability (Jaffe & Jaffe, 1990). While, opiate use is not typically associated with violence, there is a clear link between it and other forms of antisocial behaviour. Heroin use has a history of being associated with income-generating crime (Bennett et al., 2008; Jarvis & Parker, 1989; Stewart, Gossop, Marsden & Rolfe, 2000). Criminal involvement of heroin users has also been shown to be consistently and independently predicted by lack of salary (Marel, Mills, Darke, Ross, Slade, Burns & Teesson, 2013), and drug treatment of heroin is associated with a reduction in both heroin use and acquisitive crime (Jones, Hayhurst, Millar, Pierce, Dunn, & Donmall, 2016).

Although the literature around the detrimental effects of drug use generally considers alcohol as being one of the most harmful drugs, there are many drugs with relatively few harmful effects particularly hallucinogens and ecstasy (Nutt, King, & Phillips, 2010). While there is some evidence indicative that hallucinogens can aggravate the effects of pre-existing psychopathology including aggressive outbursts (Reiss & Roth, 1993) and that self-destructive behaviour can occur during usage (e.g. attempting to fly from a window) (Ungerleider & Pechnick, 1999), there is insufficient evidence to suggest that hallucinogen use themselves triggers violent behaviour. Moveover, there is evidence to suggest that some drugs can be beneficial therapeutically. There is growing clinical data to suggest that MDMA can be used as a therapeutic agent for individuals with PTSD (Sessa, & Nutt, 2015). Also, drug users report that hallucinogens have a positive impact on wellbeing and mental health issues, and cause the least harm in terms of mental and physical health in comparison to other types of drugs (Carhart-Harris & Nutt, 2010).

Mental health problems

There is some evidence that having a serious mental illness is associated with violence. Rates of violence are 4-5 times greater in those with schizophrenia in comparison with the general population (Fazel, Gulati, Linsell, Geddes, & Grann, 2009). Specifically, first episode of illness seems to be a particularly risk time for violence (Large & Nielssen, 2011); although the majority of individuals with an at risk mental state or first episode psychosis have no history of violence and do not go on to commit violent crimes (Broome, Woolley, Johns, Valmaggia, Tabraham, Gafoor, Barmon, & McGuire, 2005; Langeveld, Bjorkly, Auestad, Barder, Evensen, ten Velden Hegelstad, Joa, Johannessen, Larsen, Melle, Opjordsmoen, Rossberg,

Rund, Simonsen, Vaglum, McGlashan, & Friis, 2014). One potential pathway for this relationship could involve substance use, with mental health conditions predicting substance use and vice versa. As already highlighted, substances known to impact on violent behaviour, i.e. amphetamines and cannabis, can induce psychotic experiences. Moreover, self-medication of anxiety is a risk factor for alcohol and drug dependency (Robinson, Sareen, Cox, & Bolton, 2011). Strong associations between substance use and screening positive for an at-risk mental state have been demonstrated in a prison sample (Cooper, Jarrett, Forrester, Forti, Murray, Huddy, Roberts, Campbell, Byrne, & McGuire, 2016). Substance use has already been shown to mediate the relationship between psychosis and general offending (Wallace, Mullen &, Burgess, 2004), and McKetin and colleagues (2014) demonstrated that while there was a dose-related increase in violent behaviour when an individual used methamphetamine, the odds of violence were further increased by psychotic symptoms.

In contrast, there is limited evidence that anxiety and depression are associated with violent behaviour. For anxiety, results have indicated a minimal relationship between anxiety disorders and violence (Arseneault, Moffitt, Caspi, Taylor, & Silva, 2000; Chang, Larsson, Lichtenstein, & Fazel, 2015). While some studies have indicated no association between violence and depression (Arseneault, et al., 2000; Chang et al., 2015), Coid and colleagues (2013) noted that depression was less prevalent among violent men and gang members, and suggested that violence could serve as one of several displacement activities used to counteract the harmful effects of a negative environment, including childhood maltreatment.

Childhood adversities

Childhood maltreatment has been associated with future violence. Witnessing domestic violence during childhood has been shown to be predictive of violence (Gonzalez, Kallis, Ullrich, Barnicot, Keers, & Coid, 2016; Murrell, Christoff, & Henning, 2007). Gonzalez and colleagues (2016) noted that witnessing domestic violence predicted a three-fold increase in risk for adult violence through a direct pathway, with psychotic symptoms as a partial mediator. Potential explanations include there being a genetic susceptibility for violence transmitted through the family (Caspi, McClay, Moffitt, Mill, Martin, Craig, Taylor, & Poulton, 2002), as well as through social learning where children learn to view violence as an appropriate and justified response to disagreements (Huesmann & Kirwil, 2007). It has also

been suggested that repeated exposure to domestic violence can lead to desensitisation whereby the emotional arousal triggered by exposure diminishes over time (Molitor & Hirsch, 1994). Recent evidence has indicated that witnessing domestic violence is significantly associated with overall psychopathy level in incarcerated male offenders, and particularly the interpersonal/affective features of psychopathy (Dargis & Koenigs, 2017).

Being placed in care has also been shown to be related to adverse outcomes including offending from childhood. Foster children show greater values on measures of behaviour problems, with between 36% to 61% reaching scores over the clinical cut-off (Clausen, Landsverk, Ganger, Chadwick, & Litrownik, 1998; Holtan, Rønning, Handegard & Sourander, 2005; Tarren-Sweeney & Hazell, 2006), and substantially more looked after children are convicted or subject to a final warning or reprimand compared to children living with their family (Department for Education, 2013). While much of the literature has focused on general externalising psychopathology, there is emerging evidence that being a looked after child is predictive of violent offending in early adulthood (Elonheimo et al., 2011).

Other childhood maltreatment variables have demonstrated variable relationships with violence. Reviews by Maas and colleagues (Maas, Herrenkohl, & Sousa, 2008) and Malvaso et al (Malvaso, Delfabbro, & Day, 2016; 2015) suggested that early physical abuse is the most consistent predictor of youth violence, and is associated specifically with violent crime in adults. However, Baskin and Sommers (2011) noted that victims of childhood physical abuse were at increased risk for arrest for non-violent crimes over violent ones, and while Gonzalez and colleagues observed that childhood physical abuse was associated with intimate partner violence, this was fully mediated by alcohol dependence. Similarly, being bullied has been found to be associated with adult violence by some studies (Gonzalez et al., 2016), whilst others have found that although it's not independently associated with violence (Klomek, Sourander, & Elonheimo., 2015), there is some evidence to suggest that concurrent psychopathology fully accounts for the relationship between being bullied and later offending (Sourander et al., 2011).

There seems to be limited evidence for childhood sexual abuse predicting violent offending. A recent review of the impact of childhood sexual abuse on adult outcomes indicted that studies regarding childhood sexual abuse and offending is scarce, and found only small effect sizes for prediction of violent offending (deJong,

Alink, Bijileveld, Finkenauer, & Hendriks, 2015). A subsequent study by Gonzalez et al. 2016 found no independent associations were observed between childhood sexual abuse and adult violence, with a non-significant trend toward negative associations following adjustments. There also appears to be a gender difference in the findings; childhood sexual abuse has been found to be significantly related with aggression and intimate partner violence for women, but not for men (Trabold, Swogger, Walsh, & Cerulli, 2015).

Current study

The aim of the current study is to examine the demographic, childhood adversity, adult disadvantage and emerging mental health predictors of violent offending within a large sample of newly convicted adult male offenders. By understanding the pattern of risk factors of an index offence, the proposed study could improve the accuracy of assessment by tailoring it to ensure all relevant risk factors are considered. Moreover, determining predictors of offending retrospectively can also be helpful prospectively by suggesting what specific targeted interventions would be most useful to reduce future offending.

Based on the previous research, the following hypotheses are:

1. Age is inversely related to violent offending.
2. Alcohol and stimulant use would predict violent offending, and the effect of alcohol will be partially mediated through stimulant use.
3. Frequent cannabis use is expected to predict violence.
4. No relationship is expected between opiates or hallucinogens and violence.
5. Psychosis symptoms are expected to be related to violence by way of a full mediation through stimulants.
6. Witnessing domestic violence, childhood physical abuse and being in a children's home, are expected to directly predict violent offending. Witnessing domestic violence is also expected to have an indirect effect on violent offending via psychosis symptoms. Bullying is expected to be related to violence, fully mediated by psychopathology. Other childhood adversities, such as sexual abuse, are not expected to be significantly related to violent offending.

Method

Setting and procedure

The study took place in three London prisons. The data used in this study were collected by the London Early Detection and Prevention in Prison (LEAP) Team (Evans, Forrester, Jarrett, Huddy, Campbell, Byren, Craig, & Valmaggia, 2017). LEAP screens all new prisoners below 40 years upon reception into prison for early detection of at-risk mental states for emerging mental health problems. The primary aims of the team were to deliver early detection followed by early therapeutic intervention in prison.

Screening took place between 2011 and 2014. The daily reception register was checked every day by a researcher. Individuals who met the inclusion criteria were approached and recruited if they could provide written and oral informed consent. Screening was conducted face to face over one session by a staff member who was trained and supervised by the consultant clinical psychologist of the service. Due to restrictions on time within the prison, and to maximise the number of screens conducted, screening assessments were limited to approximately 30 minutes. When positive for the screening, prisoners were assessed for at-risk mental state via a semi-structured interview; however, these data were not included in this current study. For further details see Evans and colleagues (2017).

Participants

Prisoners were 2578 male offenders, who lived in the catchment area of South London and Maudsley Foundation Trust (SLAM). The mean age was 25.61 years old (standard deviation=5.20, range 18-40 years). The participants had committed a range of crimes including murder (n=13), sexual offences (n=53), other violent crimes (n=700), property crimes (n=678), drug offences (n=422), driving offences (n=141), possession of an offensive weapon (n=149), breach of conditions (n=41), and any other non-violent offence (n=381). To meet inclusion criteria for LEAP screening participants needed to be newly received from the courts, aged between 18-40, and without a previous history of psychosis. Prisoners with a previous history of psychosis, who had been transferred from other prisons, or with insufficient English to be assessed with the screening structured interview were excluded. Approximately 67% of those eligible were screened (10% refused because they did not feel think they had a mental health problem and 23% were missed because they were participating in a concurrent prison activity).

Measures

Offence

Violent crimes included: murder, attempted murder, sexual offences, robbery, grievous bodily harm, actual bodily harm and common assault. Non-violent crimes included burglary, fraud, forgery, criminal damage, theft, handling of stolen goods, drug offences, driving offences, possession of an offensive weapon, breach of conditions, and any other non-violent offence.

Demographics

Age, employment, qualifications, ethnicity, accommodation, family psychiatric history, legal status (awaiting trial or convicted), and first time in prison or returning to prison were all recorded.

Mental health indicators

Depression and anxiety were measured on a self-rating between 0 (not at all) and 10 (extremely). Participants were also asked whether they had ever (i) self-harmed and/or (ii) attempted suicide. If either of these questions was endorsed, information was sought on (i) most recent incident (ii) age at first incident and (iii) overall number of incidents for each.

Participants' at-risk mental state was measured using the for prison modified version of the Prodromal Questionnaire – Brief Version (PQ-B; Loewy, Pearson, Vinogradov, Bearden, & Cannon, 2011, modified version Jarrett et al 2012), which is a 24-item questionnaire. Each question elicits a yes/no answer. Participants who answered 'yes', were asked how strongly they agreed that the experience caused distress. A cut-off point of endorsement of five or more items indicated a positive screen (Jarrett, Craig, Parrott, Forrester, Winton-Brown, Maguire, & Valmaggia, 2012).

Childhood trauma

Participants were asked whether they had ever: been bullied, been hit repeatedly, seen or heard domestic (family) violence, been separated from parents for over a year, lived in a children's home, experienced any unwanted sexual experiences, experienced a serious injury or assault, and experienced discrimination due to ethnicity. Participants who answered 'yes' were asked when the trauma started and ended. Items were coded '1' if they answered yes, and '0' if they answered no.

Participants who endorsed having a serious injury or assault were asked a follow up question of what was the cause of injury. The options included violence by another person, self-injury, accident and illness.

Substance use

The modified version of the Cannabis Experience Questionnaire (CEQ; Barkus, Stirling, Hopkins, & Lewis, 2006; Di Forti, Morgan, Dazzan, Pariante, Mondelli, Marques, Handley, Luzi, Russo, Paparelli, & Butt, 2009) was used to prompt detailed information on drug use. In addition to measuring alcohol daily use, the CEQ allows the assessment of current monthly usage for each substance. The psychometric properties of this instrument have been recognised (Barkus et al., 2006) and the measure has been used to assess substance use in people with schizotypy (Barkus et al., 2006), psychosis (Di Forti et al., 2009), and at-risk mental state for psychosis in both the community (Valmaggia, Day, Jones, Bissoli, Pugh, Hall, Bhattacharyya, Howes, Stone, Fusar-Poli, & Byrne, 2014), and prisoners (Cooper et al., 2016). The use of the following substances was assessed: alcohol, commercial weed or hash, skunk, crack cocaine, powder cocaine, other stimulants (i.e. amphetamines and methamphetamines), opioids and hallucinogens.

Daily alcohol use was measured by the item 'number of drinks on a typical day', and was categorised as: 'none', '1-2', '3-4', '5-6'. '7-9', and '10 or more'. This was included as a categorical variable in analyses.

Current use of substances was measured by the item 'how often do you smoke/use X' for each substance. The responses included 'never', 'once or twice ever', 'once a month', 2-3 times a month', 'weekly', 'daily or almost daily'. Because of the small numbers of participants who endorsed some of the responses, and the resulting difficulties associated with this (such as overly inflated coefficient and odds ratio sizes), and because questionnaires are designed so that there is an approximately similar increase between each item option, the current use of substances variables were included as continuous variables in analyses.

Statistical analysis

The analyses were done in several steps:

1. Because of the large number of variables a pre-selection of variables not included in the research hypotheses was conducted using simple univariate logistic

regressions, or – for age – using an independent samples t-test. This was conducted so that any other important predictors, other than those identified in the hypotheses, could be identified and included in further analyses. In addition, variables that were not expected to be related in the models were examined to show that they are not related. All demographic, childhood adversity, mental health and substance use independent variables were assessed at whether they significantly predicted violent offending. All variables with $p<0.1$ were included for subsequent multivariate analyses to avoid losing variables which may be of importance in conjunction with other predictors.

2. To assess for multicollinearity between variables, categorical variables were dummy coded, correlations were conducted between all independent variables and the variance inflation factor (VIF) values were assessed. Multicollinearity refers to predictors that are correlated with other predictors. When this occurs the standard errors of the coefficients increases and makes some variables statistically unrelated to violence when there should be a significant relationship. Correlations were checked to see that variables did not correlate with each other by more than 0.7. VIF values were also examined; values higher than 10 are generally regarded as indicating multicollinearity.

3. A logistic regression model was conducted examining which demographic variables significantly predicted violent offending. This analysis was conducted so the most important control variables could be identified and included in subsequent regression and path models.

4. In the next step we used Baron and Kenny's (1986) approach of identifying potential mediators Mediation is a hypothesised causal chain where one independent variable X affects a mediating variable Y, which in turn affects the outcome variable Z (see Figure 2). The mediator variable clarifies the nature of the relationship between the independent variable and the dependent variable.

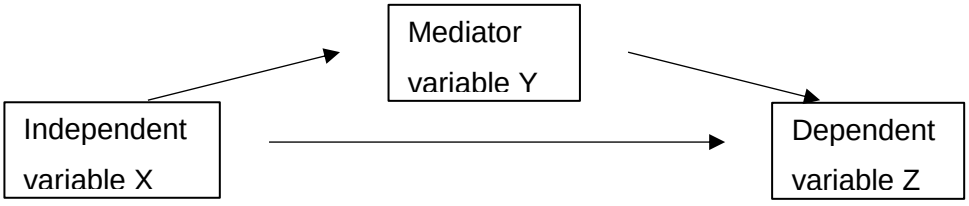

Figure 2. Simple mediation model.

According to Baron and Kenny (1986) there are several steps to check for mediation. Firstly, X should be significantly predictive of Z. Secondly, X should be significantly predictive of Y. Finally, when all three variables are included in the model, Y should be significantly predictive of Z, and the relationship between X and Z has greatly reduced or become non-significant. A full mediational model is when the intervening mediator Y explains the correlation between X and Z. If X still influences Z after including the mediator Y in the model, the model is consistent with partial mediation. If when Y is added to the model it is not significantly related to Z, and X becomes non-significant, then it is likely that X and Y are confounding variables that share common variance.

Controlling for the statistically important demographic variables, three separate logistic regressions predicting violent offending were then conducted to assess for potential mediation: firstly, including childhood adversity predictor variables; secondly, including the potential mediator mental health predictors; and lastly, including substance use another potential mediator.

5. Based on the results of stage 4 where potential predictors and mediators were identified, a hierarchical logistic regression predicting violent offending was conducted that included all the childhood adversity, mental health and substance use variables of interest. Any theoretically important variables integral to the research hypotheses were also included, i.e. age, stimulant use, alcohol use, weed use, emerging psychosis risk, witnessing domestic violence, serious injury due to violence by another person, having lived in a children's home, and bullying. Potential confounding demographic variables were again included. This was conducted for the same reasons identified in analysis number 4; possible mediating and confounding variables could be identified if a previously significant relation between one variable and violence became non-significant when an additional variable was added to the model.

6. A path model predicting violent offending was tested that measured each of the research hypotheses with a model. This included: the direct effect of age, the direct effect of stimulant use, the direct effect of alcohol use, the direct effect of weed use, the indirect effect of alcohol through stimulant use, the indirect effect of psychosis risk through stimulant use, the direct effect of witnessing domestic violence, the direct effect of serious injury due to violence by another person, the direct effect of

having lived in a children's home, the indirect effect of having lived in a children's home through psychosis risk, and the indirect effect of bullying through psychosis risk (see Figure 3).

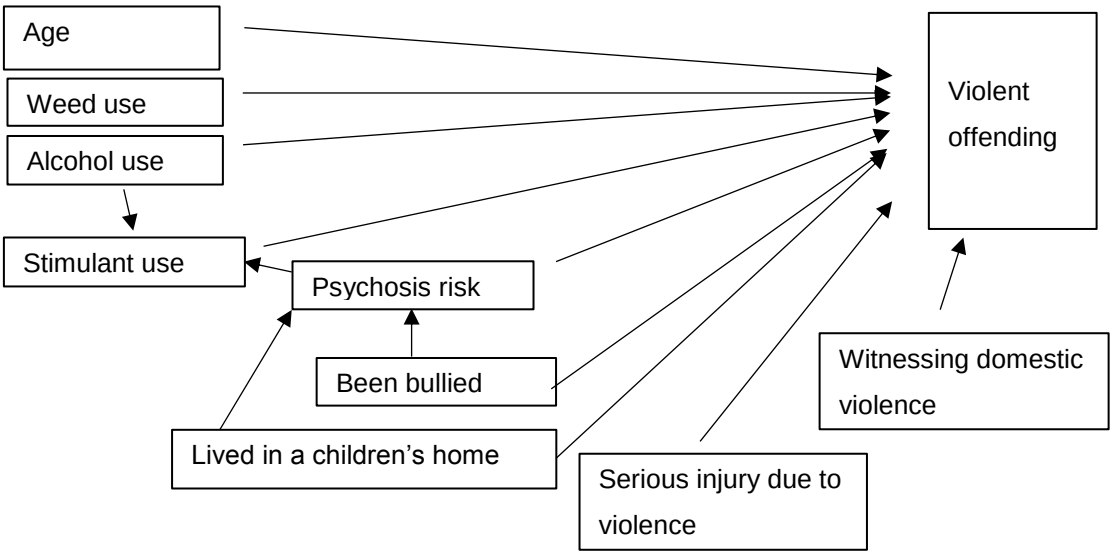

Figure 3. Theoretical path model

Any additional statistically important variables that had been identified from previous logistic models were included in the path model. The important demographic variables identified from the previous logistic regression were included in the path model as control variables.

7. To identify a parsimonious model all paths that had a *p* value of more than 0.1 were removed from the first path model, which resulted in a final path model. Any paths with a *p* value more than 0.05 but less than or equal to 0.1 to avoid removing paths due to low power of the path model.

Model fit assessment

The goodness of fit of the path models was further assessed by performing a test for lack of fit using the x^2 goodness-of-fit statistic and assessing the Comparative Fit Index (CFI) and the root mean square error of approximation (RMSEA). A good fit of a target model is obtained when the x^2 goodness-of-fit test is not significant, the RMSEA value is less than 0.05 (adequate fit < 0.08) and the CFI is >0.95 (adequate

fit >0.90). The final model is presented as a path diagram with standardised regression coefficients.

Mediation analyses were performed with MPlus (Muthén & Muthén, 2008). All other analyses were performed using SPSS.

Ethical approval

An Audit and Service Evaluation Approval was obtained from the South London and Maudsley NHS Foundation Trust to analyse the data collected as part of the routine clinical screening offered by LEAP.

Results

1. Preselection of variables

Demographic variables

The descriptive statistics are summarised in Table 2, and indicate several significant differences in terms of their demographic presentation. As expected, the violent males were younger than the non-violent males, which was confirmed an independent samples t-test (t (2580) = 6.19, p<0.01). Employment was significantly related to offence type (x^2 (3) = 8.06, p<0.05); the odds of being in prison for a violent offence as a student were 30% higher than their unemployed counterparts. Offending type was significantly related to housing (x^2 (3) = 10.3, p<0.05), with the odds of being in prison for a violent offence as an individual living in temporary accommodation being just under 25% more likely than those in fixed accommodation. Highest qualification was also related to offence type (x^2 (5) = 19.9, p<0.01); compared to those with no qualifications, the odds of having committed a violent crime for individuals who had an NVQ were 26% higher. Also, the odds of being in prison for a violent offence were over 50% lower for those with a degree. Being incarcerated for the first time (x^2 (1) = 1.81, p=0.18), ethnicity (x^2(6) = 11.4, p=0.08), and having a family history of a mental illness (x^2 (2) = 5.55, p=0.06) were not significantly related to offence type.

Substance use

In terms of current substance use, alcohol was the most used substance for both violent and non-violent offenders. 75.2% of violent offenders and 73.4% of non-violent offenders reported having at least one alcoholic drink per day. Non-violent offenders tended to drink fewer drinks a day compared to violent offenders; whereas more violent offenders (27.1%) than non-violent offenders (20.3%) reported that they drank 7 or more drinks per day. Results from a logistic regression indicated that alcohol use was significantly related to violent offending (x^2 (5) = 17.5, p<0.01); the odds of being in prison for a violent offence as a person who drinks 10 or more drinks a day were nearly 60% higher than those who report no alcohol use, while there were little diffierences between smaller alcohol use categories and no alcohol use.

As expected, current monthly stimulant use was significantly related to offence type in the univariate logistic regression (x^2 (1) = 6.71, p<0.0*1*). The odds of being in prison for a violent offence increased by 23% with each category unit increase in

monthly usage. In contrast, cocaine (x^2 (1) = 0.22, p=0.64) and crack cocaine (x^2(1)=1.35, p=0.25) showed no relationship with violent offending.

Skunk and weed were the second and third most used substances within the sample. 41.8% of violent offenders and 42.3% of non-violent offenders reported using skunk and 24.6% of violent prisoners and 26.9% of non-violent offenders reported using weed once a month or more. Neither weed (x^2 (1) = 1.42, p=0.23*)* nor skunk monthly use (x^2 (1) = 0.01, p=0.96*)* were significantly related with violent offending.

As expected, hallucinogen use was unrelated to violent offending (x^2 (1) = 0.82, p=0.39), whilst opioid use was significantly and inversely related to violent crime (x^2 (1) = 6.23, p<0.05). The odds of being in prison for a violent offence decreased by 12% for every category unit increase in monthly usage.

Mental health problems

The results indicated a tendency for violent offenders to endorse more mental health difficulties. The odds of being in prison for a violent offence were 27% greater for individuals who screened positive on the prodromal questionnaire compared to those who screened negative (x^2 (2) = 6.50, p<0.05). Having a history of attempting suicide was significantly related to violent offending (x^2 (1) = 6.19, p<0.05) with the odds of being incarcerated for a violent offence being 40% higher for individuals who had attempted suicide versus those without a history of suicide attempts. Current anxiety (x^2 (1) = 1.66, p=0.20), current depression (x^2 (1) = 1.30, p=0.26), and having ever self-harmed (x^2 (1) = 0.19, p=0.66) were all not significantly related to violent offending.

Childhood adversities

Violent offenders also showed a higher propensity to report childhood adversity than their non-violent counterparts. As expected, witnessing domestic violence increased the odds of being in prison for a violent offence by over 30% (x^2 (1) = 10.6, p<0.01). Individuals who spent time in a children's home were just under 25% more likely to have committed a violent offence in comparison to those who had not been in care (x^2 (1) = 4.22, p<0.05). Being seriously injured as a result of violence by another person was significantly related to violent offending (x^2 (1) = 7.58, p<0.01), whilst being hit repeatedly was not related (x^2 (1) = 2.30, p=0.13). Being

bullied (x^2 (1) = 1.04, p=0.31), having parents separated (x^2 (1) = 0.10, p=0.76), having experience unwanted sexual contact (x^2 (1) = 0.27, p=0.61), experiencing racial discrimination (x^2 (1) = 0.07, p=0.80), and having a serious injury due to oneself (x^2 (1) = 3.50, p=0.06) were all not significantly related to violent offending.

Table 2. Demographic characteristics, univariate regression coefficients and odds ratios for the prison sample

Variables	Violent (n=766)	Non-violent (n=1817)	Coefficient	Odds Ratio
Age (SD)	24.5 (5.06)	26.0 (5.20)	-	-
First time in prison	38.3% (293)	40.8% (742)	0.12	1.13
Has a family history of mental illness	24.2% (185)	21.0% (382)	1.40	4.05
Ethnicity (n):				
White British	26.5% (203)	24.4% (444)	0.00	1.00
White Other	6.5% (50)	8.2% (149)	-0.31	0.73
Black British	17.5% (134)	18.8% (341)	-0.15	0.86
Black African	11.4% (87)	11.6% (211)	-0.10	0.90
Black Caribbean	17.2% (132)	14.4% (261)	0.10	1.11
Mixed	10.3% (79)	9.0% (163)	0.06	1.06
Other	10.6% (81)	13.6% (248)	-0.34	0.71
Employment (n):				
Paid/self-employed	32.9% (252)	36.7% (666)	-0.10	0.90
Student	17.2% (132)	13.2% (240)	0.27*	1.31
Other	3.1% (24)	3.0% (55)	0.04	1.04
Unemployed	46.7% (358)	47.1% (855)	0.00	1.00
Housing (n):				
Fixed abode	69.3% (531)	71.3% (1295)	0.00	1.00
Temporary accommodation	22.6% (173)	18.7% (339)	0.22*	1.25
Homeless	5.4% (41)	5.3% (97)	0.03	1.03
Other	2.6% (20)	4.6% (84)	-0.54	0.58
Highest qualification (n):				
None	24.3% (186)	26.0% (472)	0.00	1.00
GCSE	23.2% (178)	22.1% (401)	0.12	1.12
Vocational or NVQ	34.3% (263)	29.3% (532)	0.23*	1.26
A Level or Diploma	10.8% (83)	12.1% (219)	-0.04	0.96

Degree	2.1% (16)	5.1% (93)	-0.83*	0.43
Other	3.5% (27)	4.1% (75)	-0.90	0.91
Substance use:				
Typical drinks per day:				
None	24.8% (190)	26.6% (483)	0.00	1.00
1-2	19.3% (148)	20.3% (368)	0.02	1.02
3-4	16.3% (125)	18.7% (339)	-0.07	0.94
5-6	12.4% (95)	13.9% (251)	-0.04	0.96
7-9	6.9% (53)	6.6% (120)	0.12	1.12
10+	20.2% (155)	13.7% (249)	0.46***	1.58
Monthly use of stimulants:			0.21**	1.23
Never	94.0% (720)	96.5% (1753)		
Once or twice ever	2.1% (16)	0.9% (17)		
Once a month	0.9% (7)	0.8% (14)		
2-3 times	0.8% (6)	0.3% (6)		
Weekly	1.3% (10)	0.4% (8)		
Daily/ almost daily	0.3% (2)	0.4% (7)		
Monthly use of weed:			0.03	1.03
Never	73.6% (564)	77.2% (1403)		
Once or twice ever	1.8% (14)	0.6% (10)		
Once a month	2.9% (22)	2.6% (47)		
2-3 times	3.7% (28)	2.6% (47)		
Weekly	3.4% (26)	4.1% (75)		
Daily/ almost daily	13.8% (106)	12.4% (226)		
Monthly use of ‘skunk’:			-0.01	0.99
Never	57.3% (439)	57.0% (1035)		
Once or twice ever	0.9% (7)	0.7% (13)		
Once a month	2.1% (16)	2.1% (38)		

2-3 times	3.3% (25)	3.2% (58)		
Weekly	3.8% (29)	4.0% (73)		
Daily/ almost daily	20.5% (157)	20.3% (368)		
Monthly use of cocaine:			0.02	1.02
Never	89.9% (689)	91.4% (1660)		
Once or twice ever	1.7% (13)	1.2% (21)		
Once a month	2.3% (18)	1.6% (29)		
2-3 times	1.6% (12)	1.3% (23)		
Weekly	2.7% (21)	2.0% (36)		
Daily/ almost daily	0.9% (7)	2.0% (36)		
Monthly use of crack cocaine:			-0.05	0.95
Never	93.0% (712)	91.9% (1670)		
Once or twice ever	0.9% (7)	0.7% (13)		
Once a month	0.5% (4)	0.5% (9)		
2-3 times	0.9% (7)	0.7% (12)		
Weekly	0.9% (7)	1.2% (21)		
Daily/ almost daily	3.7% (28)	4.8% (88)		
Monthly use of opioids:			-0.12*	0.88
Never	95.4% (731)	92.5% (1681)		
Once or twice ever	0.4% (3)	0.3% (5)		
Once a month	0.0% (0)	0.4% (8)		
2-3 times	0.1% (1)	0.3% (6)		
Weekly	0.4% (3)	0.3% (6)		
Daily/ almost daily	3.7% (28)	5.8% (105)		
Monthly use of hallucinogens:			-0.29	0.75
Never	98.8% (757)	98.4% (1788)		
Once or twice ever	0.8% (6)	1.0% (19)		
Once a month	0.1% (1)	0.2% (3)		

2-3 times	0.0% (0)	0.0% (0)		
Weekly	0.0% (0)	0.0% (0)		
Daily/ almost daily	0.0% (0)	0.1% (1)		
Mental health issues:				
PQ screen positive (n)	31.7% (243)	26.3% (477)	0.24*	1.27
Anxious in last month, scale 1-10 (SD)	4.46 (3.49)	4.25 (3.56)	0.02	1.02
Depressed in last month, scale 1-10 (SD)	4.37 (3.63)	4.18 (3.54)	0.02	1.02
Ever self-harmed (n)	10.8% (83)	10.2% (186)	0.06	1.06
Ever attempted suicide (n)	13.3% (102)	9.9% (180)	0.33*	1.40
Childhood adversities:				
Witnessed domestic violence	24.8% (190)	23.0% (418)	0.29**	1.34
Ever been hit repeatedly	34.1% (261)	31.0% (564)	0.14	1.15
Experienced serious injury due to violence from family or another person	41.0% (314)	34.3% (623)	0.31**	1.37
Experience serious injury due to self	0.5% (4)	0.1% (2)	1.56	4.77
Lived in a children's home	44.1% (338)	43.5% (791)	0.22*	1.24
Ever been bullied	22.8% (175)	19.3% (351)	0.10	1.11
Separated from parents	5.6% (43)	5.1% (93)	0.03	1.03
Had unwanted sexual experiences	19.5% (149)	15.2% (276)	0.10	1.10
Discriminated against due to ethnicity	23.2% (178)	22.8% (414)	0.03	1.03

2. Assessment of multicollinearity

Correlations and multicollinearity analyses were undertaken. None of the variables correlated with each other by more than 0.7. The categorical demographic variables (employment, housing, qualifications, and ethnicity) VIF values were all above 10, suggesting an issue with multicollinearity. Because partial multicollinearity among confounding control variables does not reduce their effectiveness at reducing bias (Voss, 2004), the demographic variables were not removed from subsequent analyses. All other variables VIM values were lower than 10, indicating no obvious issue with multicollinearity.

3. Assessment of demographic control variables

A multiple logistic regression of violent offending was conducted that included all the demographic variables (see Appendix 1). The model was significant (x^2 (20) = 79.6, p<0.01), and indicated that age (x^2 (1) = 28.0, p<0.01) and housing (x^2 (1) = 11.3, p<0.01) were the only two demographic variables that explained a significant proportion of the variance. Age and housing were therefore included as control variables in subsequent regression analyses.

4. Logistic regressions

Firstly, a logistic regression model including childhood adversity variables was used to predict violent offending. Controlling for age and housing, the model was statistically significant (x^2 (9) = 18.5, p<0.01) (see Appendix 2). Witnessing domestic violence (x^2 (1) = 4.46, p<0.05) remained a significant predictor of violent offending, whilst all other variables that were significant in univariate analyses were not significantly related anymore (i.e., having lived in a children's home and being seriously injured due to violence by another person). These data indicate the possibility of mediation having occurred, with witnessing domestic violence acting as a mediator for both having lived in a children's home and being seriously injured due to violence by another person. However, mediation requires the assumption of causality and temporal ordering among the three variables under study. It is unlikely that being in a children's home lead to witnessing domestic violence, rather than witnessing family violence leading to being placed in care. Moreover, it does not necessarily make sense that being seriously injured by another person in some ways causes seeing or hearing violence in the family home. It therefore makes more theoretical sense that being in a children's home and being seriously injured

due to another person share common variance with other variables in the model, which has resulted in them losing predictive power.

The model including mental health variables that controlled for age and housing was also significant (x^2 (7) = 11.7, p<0.01) (see Appendix 3). Having a history of suicide attempts remained a significant predictor of violent offending (x^2 (1) = 4.31, p<0.05), whilst screening positive on the prodromal questionnaire was no longer significantly related (x^2 (2) = 3.57, p=0.17). Whilst this could indicate possible mediation, the temporal properties of the variables (current psychosis risk and having a history of suicide attempts) means mediation does not make sense in this situation. Again, it is more likely that current psychosis risk shares common variance with other variables in the model, which has resulted in it losing predictive power.

Finally, the model that controlled for age and housing and included substance use was also significantly predictive of violent offending (x^2 (12) = 81.7, p<0.01). Typical alcoholic drinks per day (x^2 (5) = 16.4, p<0.01), and monthly stimulant use (x^2 (1) = 8.56, p<0.01) were both significantly and positively related to violent offending. Monthly opiate use was significantly and negatively predictive of violent offending (x^2 (1) = 3.56, p<0.05). Monthly weed use was not significantly related (x^2 (1) = 1.55, p=0.21) (see Appendix 4).

5. Hierarchical regression model including all key childhood adversity, mental health and substance use variables

Table 3 illustrated the hierarchical regression model predicting violent offending. Demographic control variables were entered first (block I), followed by childhood adversity variables (block II), then mental health variables (block III), and finally substance use variables (block IV).

The hierarchical regression model predicting violent offending that included demographic, childhood adversity, mental health, and substance use variables was significant at every block except when including the mental health variables (block I x^2 (4) = 50.2, p<0.01; block II x^2 (4) = 15.18, p<0.01; block III x^2 (3) = 4.30, p=0.23; block IV x^2 (8) = 23.0, p<0.01; final model x^2 (19) = 92.7, p<0.01). This means that adding mental health variables did not add any significant information to the model. When the mental health variables were included in the model the childhood adversity measures were no longer significant. Given that neither mental health

variable reached statistical significance in the model it is unlikely that they are mediating the relationship between childhood adversity variables and violence; rather, the childhood adversity and mental health variables are likely to have shared variance.

Table 3. Hierarchical logistic regression predicting violent offending based on childhood adversity, mental health and substance use variables with demographic controls.

Variables	I			II			III			IV		
	B	x^2	Odds ratio	B	x^2	Odds ratio	B	x^2	Odds ratio	B	x^2	Odds ratio
Age	-0.0	37.7***	0.95	-0.06	38.6***	0.95	-0.06	40.1***	0.94	-0.06	34.6***	0.95
Housing:	-	12.4**	-	-	11.1**	-	-	9.91*	-	-	11.5**	-
Fixed abode	0.00	-	1.00	0.00	-	1.00	0.00	-	1.00	0.00	-	1.00
Temporary	0.30	7.32**	1.34	0.28	6.28**	1.32	0.26	5.34*	1.29	0.29	6.81**	1.34
Homeless	0.16	0.61	1.17	0.12	0.33	1.12	0.06	0.08	1.06	0.08	0.15	1.08
Other	-0.49	3.60*	0.62	-0.49	3.66*	0.61	-0.49	3.58*	0.62	-0.49	3.59*	0.61
Witnessing domestic violence				0.20	4.29*	1.22	0.16	2.76	1.18	0.14	1.90	1.15
Serious injury due to violence by another person				0.21	3.09	1.23	0.19	2.43	1.20	0.15	1.63	1.17
Lived in a children's home				0.14	1.63	1.15	0.12	1.15	1.13	0.09	0.69	1.10
Being bullied				0.12	1.15	1.12	0.05	0.19	1.05	0.06	0.28	1.06
Prodromal questionnaire screening:							-	0.91	-	-	0.57	-
Negative							0.00	-	1.00	0.00	-	1.00
Positive							0.10	0.75	1.10	0.07	0.33	1.07
Psychotic							-0.18	0.09	0.83	-0.26	0.18	0.77
History of attempted suicide							0.24	2.58	1.28	0.22	2.03	1.25
Typical drinks per day:										-	9.86	-
None										0.00	-	1.00
1-2										0.03	0.04	1.03
3-4										-0.10	0.49	0.91
5-6										-0.16	1.02	0.86
7-9										0.08	0.15	1.08
10+										0.30	4.50*	1.35
Monthly use of stimulants										0.23	7.46**	1.26
Monthly use of opiates										-0.13	4.92*	0.88
Monthly use of weed										0.02	0.48	1.02
Constant	0.48	-	-	0.35	-	-	0.37	-	-	0.05	-	-

6. Path model assessing research hypotheses

Figure 4 illustrates path model that tested the research hypotheses. This included: the direct effect of age, the direct effect of stimulant use, the direct effect of alcohol use, the direct effect of weed use, the indirect effect of alcohol through stimulant use, the indirect effect of psychosis risk through stimulant use, the direct effect of witnessing domestic violence, the direct effect of serious injury due to violence by another person, the direct effect of having lived in a children's home, the indirect effect of having lived in a children's home through psychosis risk, and the indirect effect of bullying through psychosis risk. The initial model showed a poor fit of the data (x^2 (13) = 220.2, p<0.01, RMSEA = 0.08, CFI = 0.53).

Research hypotheses

The path analyses indicated that age was negatively and significantly directly predictive of violent offending (p<0.01). Monthly stimulant use was positively and significantly directly predictive of violence (p<0.01). Whilst alcohol use was not directly positively predictive (p=0.86) it was indirectly and positively predictive of violence through stimulant use (p<0.01). Weed monthly usage were not directly linked to violent offending (p=0.25), but there was a trend indicating that opioid use negatively directly predicts violence (p=0.06). Psychosis risk was not positively and directly predictive of violence (p=0.96); however, it was indirectly predictive when monthly stimulant use was included as a mediator (p<0.05).

There was no evidence that witnessing domestic violence was partly mediated by screening positive on the prodromal questionnaire; in fact, the correlation coefficient was stronger through the direct path (indirect coefficient=0.01, p=0.73, direct coefficient=0.04, p=0.18). Nor was there evidence to suggest that being bullied impacted violent offending directly (coefficient=0.01, p=0.73) or indirectly through screening positive on the prodromal questionnaire (coefficient=0.01, p=0.75). In addition, having lived in a children's home (p=0.24) was not directly predictive of violence. There was a trend that being seriously injured due to violence by another person was predictive of violence, but this did not reach statistical significance (p=0.10).

Additional variables of interest identified from regression analyses

Having a history of attempting suicide was included in the path model. This was significantly and positively predictive of violent offending (p=0.05).

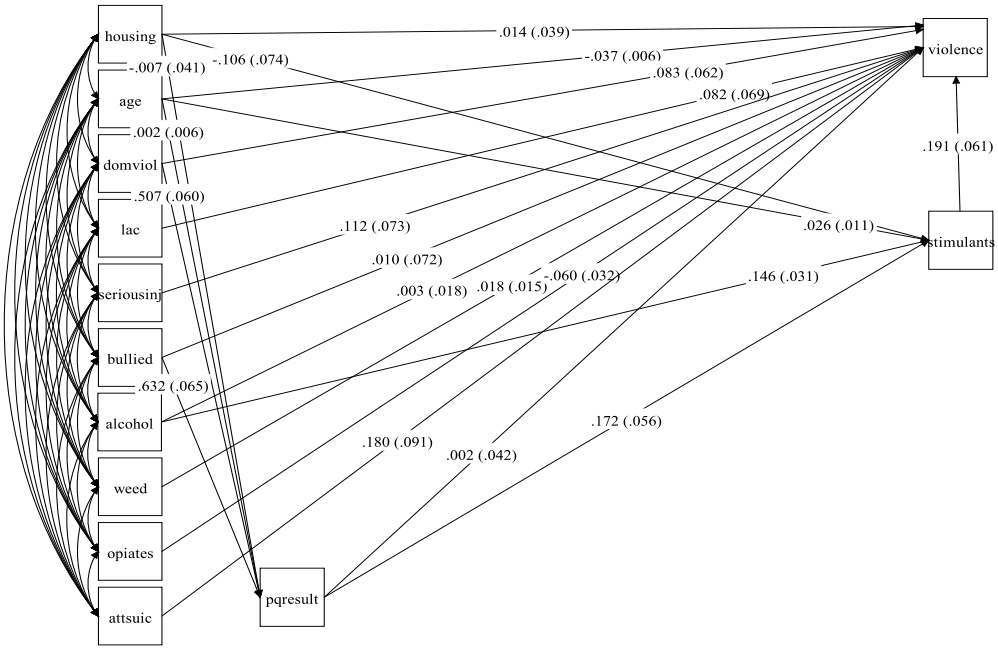

Figure 4. Initial path model testing predictors of violent offending hypotheses. Single headed arrows reflect hypothesised relationships between variables. Standardised regression coefficients are labelled next to each path, with standard error in brackets. Double headed arrows indicate the correlations between exogenous predictor variables. 'domviol' represents witnessing domestic violence, 'lac' represents being in a children's home, 'seriousinj' represents being seriously injured due to violence by another person, 'attsuic' represents having a history of suicide attempts, and 'pqresult' represents psychosis risk.

7. Revised path model

As previously explained in the Method section, to identify a parsimonious model all paths that had a *p* value of more than 0.1 were removed from the first path model, which resulted in a final path model. Figure 5 illustrates the revised path model. This model indicated a good fit with the data (x^2 (4) = 8.82, p = 0.07, RMSEA = 0.02, CFI = 0.94, R^2 = 0.08). There was further confirmation of the hypothesis that age is inversely and directly predictive of violent offending (p<0.01). In addition, not only was monthly stimulant use a direct predictor of violent offending (p<0.01), it also mediated the effect of daily alcohol use (indirect coefficient p<0.05; direct coefficient p=0.65) and screening on the prodromal questionnaire (indirect coefficient p<0.05; direct coefficient p=0.69). Monthly opiate use was inversely related to violent offending; however, this did not reach statistical significance (p=0.08).

For the childhood adversity and mental health variables, witnessing domestic violence was directly and significantly predictive of violent offending (p<0.05). Although there was a positive trend with violent offending, neither having a

childhood serious injury due to violence by another person (p=0.10) nor having a history of attempting suicide (p=0.07) were significantly and directly predictive of violent offending.

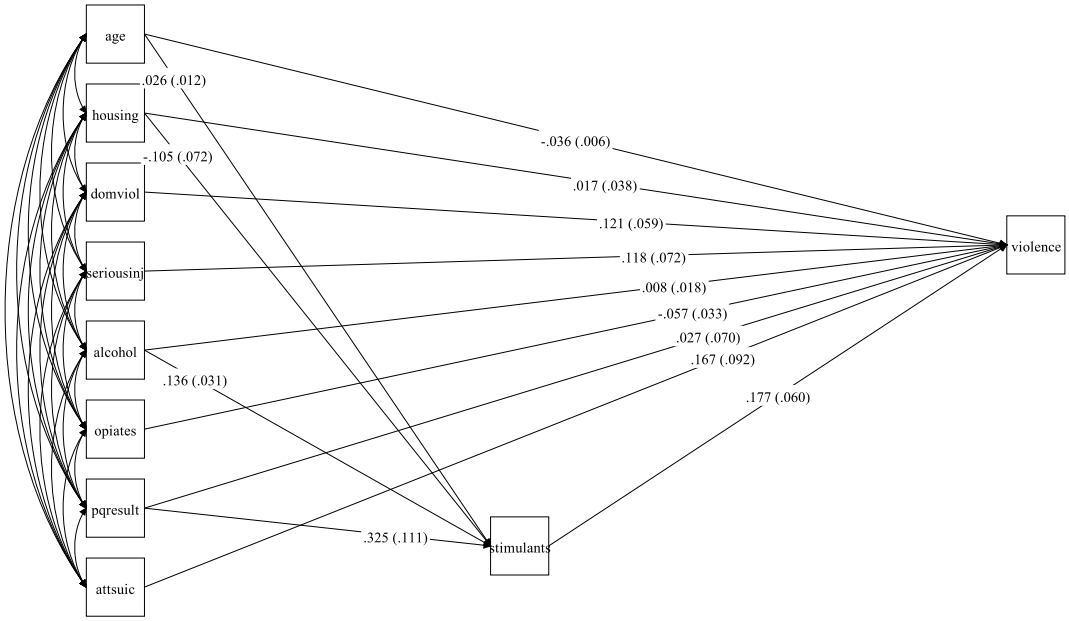

Figure 5. Revised path model testing predictors of violent offending hypotheses. Single headed arrows reflect hypothesised relationships between variables. Standardised regression coefficients are labelled next to each path, with standard error in brackets. Double headed arrows indicate the correlations between exogenous predictor variables. 'domviol' represents witnessing domestic violence, 'seriousinj' represents being seriously injured due to violence by another person, 'attsuic' represents having a history of suicide attempts, and 'pqresult' represents psychosis risk.

Discussion

In the present study, the explanatory role of childhood adversity, mental health issues, and current substance use on violent offending was examined in a population of newly incarcerated young adult male prisoners. The findings provided evidence that supported several hypotheses.

Age

Firstly, there was consistent evidence that age was inversely predictive of violent offending. This is in line with empirical evidence suggesting externalising behaviour is robustly related to age, rapidly peaking in the late teen years/early adulthood and declining thereafter, which continues into adulthood (Loeber & Farrington, 2014; Marcus, 2009; Sweeten, Piquero & Steinberg, 2013). Explanations for this have referred to the changes to the frontal lobes during early adulthood (Steinberg, 2005). Frontal lobe development sees an improvement in self- regulation and control, which are important cognitive abilities in controlling aggressive responding (Denson, DeWall, & Finkel, 2012). Moreover, neural substrates implicated in the development of empathy and emotional face processing have also been shown to develop with age (Greimel, Schulte-Ruther, Fink, Piefke, Herpertz-Dahlmann, & Konrad, 2010). This pattern may also be related to peer relationships. A recent study indicated that not only are younger men more likely to be in gangs, but that gang membership is significantly associated with having a positive attitude towards violence (Coid et al., 2013). In comparison to their non-violent counterparts, the violent offenders in this study were younger and may therefore had more difficulties regulating their anger, empathising with those around them, and/or affiliating with other individuals who endorse violent attitudes, thus resulting in aggressive criminal behaviours.

Substance use

Secondly, monthly stimulant use was directly predictive of violence. These findings provide further support that substances like methamphetamines are predictive of harmful violent behaviour (McKetin et al., 2014). There are several explanations for this finding. Chronic methamphetamine use can cause dysregulation to the fronto-limbic pathway, which can result in an increase in outward aggression (Sekine, Ouchi, Takei, Yoshikawa, Nakamura, Futatsubashi, Okada, Minabe, Suzuki, Iwata, & Tsuchiya, 2006). Moreover, methamphetamine use is implicated in sleep deprivation and having an acquired brain injury, which are both associated with poor

aggression regulation (McKetin et al., 2014; Pilcher, Ginter, Sadowsky, 1997; Tateno, Jorge, & Robinson, 2003). Additionally, drug market violence is increasingly being understood as a means used by individuals and groups to gain or maintain market share of drug trade (Brownstein, Crimmins & Spunt, 2000). Contrary to what was expected, we did not find a direct effect of daily alcohol use on violent offending in the path model, however it did indirectly impact violence through stimulant use. This result is in keeping with recent evidence that other drug use may play a more significant role in the initiation of serious violent offending during adulthood than alcohol (White et al., 2015).

As expected, stimulant use mediated the impact of emerging psychosis risk on violence. Substance abuse has been proposed as the key mediator of the association between schizophrenia and violent offending. Amphetamines and methamphetamines powerfully increase synaptic dopamine levels, and repeated exposure of this leads to a hyperdopaminergic state that can reportedly induce psychosis in vulnerable individuals (Barr, Panenka, MacEwan, Thornton, Lang, Honer et al., 2006; Lieberman, Sheitman, & Kinon, 1997). Wallace and colleagues (2004) noted that individuals with schizophrenia were far more likely to offend if they had a substance use problem. Our findings have extended on this and indicate that while emerging psychosis risk is related to violent offending in univariate analyses, this can be explained by monthly stimulant use. The results indicate that in this sample of adults, stimulant use (i.e. amphetamines and methamphetamines) is a key indicator for violent offending over and above daily alcohol use and emerging psychosis risk. These results further support the need for interventions in prisons for substance use, and more specifically stimulants.

Interestingly the results did not provide evidence to suggest that cannabis use was related to violent offending in this sample of young adult male offenders. Cannabis has been found to be associated with criminal activity, including violent (Schoeler et al., 2016) and drug-specific crime (Pedersen & Skardhamar, 2009); however, data tend to include non-criminal control populations. It is possible that no differences were found between the groups because cannabis use is associated with both forms of offending, rather than just one.

There was also evidence for a potential link between opiate use and offending typology. Opiate use was a significant negative predictor of violence in regression analyses, but only showed a trend in the path model. As discussed earlier, random

sampling error might explain why only a trend was noted. It would therefore be important to consider including opiate use in future studies that examine violent offending. It might be that opiate use is simply predictive of non-violent crime. As previously discussed, heroin use has a history of being associated with income-generating crime (Bennett et al., 2008; Jarvis & Parker, 1989; Stewart, Gossop, Marsden & Rolfe, 2000), which seems to be partly drive by a lack of income (Marel et al., 2013). The results may also be because opioid use depresses activity, which inhibits violence (Boles & Miotto, 2003).

Interestingly, cocaine and crack cocaine, despite being stimulants were not related to violent crime. Because the comparison group were non-violent offenders it might be that crack cocaine and cocaine are also associated with both non-violent and violent crime. As previously highlighted, for property crime, odds ratios have been as high as 11.5 for cocaine and 20.2 for crack cocaine (Bennett et al., 2008).

Childhood adversities

Specific childhood adversities were associated with violent offending. In line with evidence from Gonzalez and colleagues (2016), witnessing domestic violence directly predicted violence across all analyses. Explanations for this finding have drawn on social learning theory where parental conflict may result in the child learning that violence is an acceptable and valid way of solving conflicts within the family and with others (Bandura, 1986; Simons, Wu, Johnson, & Conger, 1995). Given that witnessing domestic violence has been shown to be significantly associated with overall psychopathy level in incarcerated male offenders, it may also be that witnessing domestic violence may lead to violent perpetration through diminished empathy, whereby repeated exposure to domestic violence leads to emotional desensitisation (Molitor & Hirsch, 1994).

Being in a children's home had a significant univariate relationship with violent offending but no relationship in subsequent analyses. It is possible that this variable was associated with other aspects of childhood adversity and mental health difficulties that also predict violent offending, thereby reducing its effect when included in a model with other variables it shares variance with. Children in care are vulnerable to developing mental health problems by the time that enter the care system (Mental Health Foundation, 2002). McAuley and Davis (2009) highlight children in care are more likely to have come from disadvantaged background

where numerous risk factors are present; for example, having parents who experience mental illness, drug misuse, and domestic violence (Mental Health Foundation, 2002). If these variables, i.e. witnessing domestic violence, are predictors of violent offending and have shared variance with being in a children's home, then they are likely to attenuate the relationship between having been in care and future violent offending.

There was a positive trend in the final model between having a serious injury due to violence by another person and violent offending. As already highlighted, this could potentially be explained by random sampling error. If there is indeed a relationship between this form of physical abuse, then this could be explained in several ways. Like explanations regarding witnessing domestic violence, being physically assaulted might teach the individual that this is an appropriate way of resolving situations. Additionally, being assaulted may increase the likelihood for a head injury, which in turn could result in executive functioning deficits that may exacerbate violent impulses. However, if the findings are accurate and being seriously injured due to violence by another person is not significantly predictive of violent offending then this might be because the comparison population were offenders and experienced this form of adversity. Indeed, a recent study indicated that although a history of physical abuse is strongly associated with violence, the association was not specific to violence; it was mediated by their common association with nonviolent offending (Savage, Palmer, & Martin, 2014). Further research would be valuable to explore this issue.

History of mental illness

The results demonstrated that mental illness also plays a role in violent offending. As previously discussed, psychosis risk had an indirect effect on violent offending, through stimulant use. In addition, having a history of suicide attempts was significantly related to violent offending in regression models, although there was only a trend with violent offending in the final path model. One plausible reason for the significant regression associations is that violent offending and suicidal behaviour have been shown to have common risk factors including having a parental history of suicide attempt and antisocial personality disorder and witnessing domestic violence (Brent, Melhelm, & Wilcox, 2016; Hardt, Bernert, Matschinger, Angermeier, Vilagut, Bruffaerts, de Girolamo, de Graaf, Haro, Kovess, & Alonso, 2015). There is evidence that early traumatic experiences can impact on

serotonergic functioning in animals (Matsumoto, Higuchi, Togashi, Koseki, Yamaguchi, Kanno, & Yoshioko, 2005). Reduced serotonergic functioning seems to affect impulsivity, which can lead to a greater propensity toward acting on aggressive impulses (Mann, 2003) both towards the self and others. In support of this suggestion that there is an interaction of childhood adversity, aggression towards self and others, aggressive behaviour has been shown to be an important mediator of the relationship between childhood physical abuse and suicide attempts in offenders (Swogger, You, Cashman-Brown, & Conner, 2011).

Limitations

Although this was an extensive and large-scale study of a vulnerable and often overlooked population, there were limitations. The final model accounted for 8% of violent offending variance, indicating that this is a hugely complex issue, and there are clearly other factors that help explain violent offending. Genetic and environmental factors such as having a traumatic head injury and associated executive functioning problems (Bannon, Sallis & O'Leary, 2015), polymorphism of specific genes (e.g. DAT1, COMT, MAOA; Ferguson & Beaver, 2009), and attachment problems (Savage, 2014) have been shown to be linked with violence, but these measures were not included in the assessments with prisoners. As previously mentioned, the data used in this study were collected by the London Early Detection and Prevention in Prison (LEAP) Team (Evans et al., 2017), which screens all new prisoners below 40 years upon reception into prison for early detection of at-risk mental states for emerging mental health problems. Other important variables that are implicated in violent offending were not collected because, as previously outlined, there were restrictions on screening time with prisoners and therefore only measures in line with key aims of the LEAP team were included.

The self-report measures leave the study open to weakness. As described by Cooper and colleagues (2016), not only can self-report of substance use can lead to inaccuracies, but the strengths and amounts of substances used are difficult to compare. The childhood adversity items did not include detailed information such as the onset or frequency of trauma. As reported by Hart & Rubia (2012) the effects of abusive experiences can vary according to chronological age. Additionally, the adversity items lend themselves to some subjectivity in terms of definitions, for example what constitutes a serious injury, as well as potential recall bias from the

retrospective reports. Adult retrospective reports of adverse childhood experiences are prone to false negatives (Hardt & Rutter, 2004) and these results may therefore be an under representation of the actual childhood adversity these individuals suffered. However, as previously documented by Gonzalez and colleagues (2016), data from official records of validated cases of childhood adversity would lose cases that go unreported, e.g. sexual abuse and physical injury. Finally, the mental health indicators were not based on diagnoses; however, despite the high rates of mental health problems among prisoners there is a reluctance to see help for suicidal ideation and mental health issues (Brinded, Simpson, Laidlaw, Fairley, & Malcolm, 2001; Skogstad, Deane, & Spicer, 2006), which would lead to an underrepresentation of mental health difficulties in the sample had the assessment been based on diagnoses.

The categorisation of violent and non-violent crimes used in the study were based on UK legal definitions of crimes. Any crime involving violence towards the person was categorised as a violent crime. However, while the crime of robbery requires some form of violence towards the person, it can simply involve the perceived threat of violence. It could be questioned whether some instances of robbery could be better categorised as a non-violent crime as they may have more in common with non-violent offences such as burglary and theft. Furthermore, it may also have been beneficial to consider treating offence type as a continuum, ranging from high severity violent crimes to low severity non-violent crimes.

There were also limitations with the statistical analyses used. Regression analyses were based on Baron and Kenny's (1986) mediation method, toward which several arguments have been made. Holmbeck (2002) points out that their method is vulnerable to incorrect conclusions being made. He notes if a study has a particularly large sample it is possible to observe a large change in the X->Y path upon the addition of a mediator to the model without observing a substantial drop in statistical significance. Additionally, the Baron and Kenny method is among the lowest in power, and is the least likely to detect an effect of X on Y through a mediator variable. An alternative strategy has been suggested by Preacher and Hayes, which requires only that there is an effect between X and Y, and that the indirect effect, via the mediator variable, is statistically significant in the predicted direction (Preacher & Hayes, 2004). Secondly, the model and analyses used were not able to make a contrast between mediational and confounding effects. As explained by Gonzalez and colleagues (2016), the distinction between mediation

and confounding requires conceptual understanding of the causative nature of the relationships within the model. While conceptually both housing and age were included as confounding variables in the model, the model illustrates them in a mediated relationship with stimulant use.

Recommendations

Specific interventions that target criminogenic predictors can have a considerable effect on recidivism (Aos, Miller, & Drake, 2006; Lipsey & Cullen, 2007); for example, cognitive-behavioural programs have been proven to be especially effective in reducing substance abuse and recidivism (Aos et al., 2006; Lipsey & Cullen, 2007). This research therefore has key clinical implications for those individuals who engage in the most serious crimes and pose a high risk to society (Constantinou, Freestone, Marsh, Fenton, & Coid, 2015; Douglas & Skeem, 2005).

Early intervention is clearly important in this population. Younger people are at risk of committing violent crimes in comparison with non-violent offences. Given the risk factors for violence, vulnerable individuals should be targeted and screened in the community, for example those in substance use and mental health services, and individuals in temporary accommodation such as hostels. Moreover, given that witnessing domestic violence has direct relationship with violent offending, it is imperative that children exposed to this are supported early on through primary prevention strategies aimed at preventing children witnessing domestic violence. Witnessing domestic violence is relatively under-researched compared to other forms of maltreatment. As previously recommended by Gonzalez and colleagues (2016) further research might explore whether social learning theory mechanisms are responsible for this pathway, which could inform future interventions.

As outlined by Lappin, Sara, & Farrell (2016) this comes with challenges. Assessment of adults with comorbid stimulant and mental health needs is complicated frequently by continued use of methamphetamine or other drugs. Their use of services is often intermittent, and they can often desist with psychological or pharmacological treatments. Given these issues, flexible and coordinated service models that integrate mental health and substance use services are required.

Knowledge of predictors of offending is used to risk assess for recidivism. Currently this is based on actuarial (i.e. static predictors) assessments (e.g. Violence Risk

Appraisal Guide; Quinsey, Harris, Rice, & Cromier, 1998) and structured professional judgment, which formulates static factors in combination with dynamic ones (e.g. History, Clinical, Risk Management-20; Webster, Douglas, Eaves, & Hart, 1997). However, large-scale analysis of these predictive models finds that neither approach performs above a 'threshold' AUC (Area Under Curve) value of 0.70 (Fazel, Singh & Grann, 2012; Yang, Wong & Coid, 2010) or correctly classifying only 60% of cases (Troquete, van den Drink, Beintema, Mulder, van Os, Schoevers, & Wiersma, 2014). Additionally, there are concerns that involvement in these studies by original authors of the risk assessment tools may have led to inflated estimates of accuracy (Singh, Grann & Fazel, 2011) and that for certain offender populations, predictive efficacy is no better than chance (Coid, Ullrich & Kallis, 2013). In light of this, there is a clear need for research, like this current study, to consider the complexities that underlie violent offending.

The current study aimed to examine the demographic, childhood adversity, adult disadvantage and emerging mental health predictors of violent offending within a large sample of adult male offenders newly received to prison. The results from this study indicate that for newly incarcerated male prisoners, the key risk factors that accounted for 8% of violent offending variance included witnessing domestic violence during childhood, and current use of stimulants. The data indicate that not only is this a complex issue that is likely to involve both genetic and environmental factors, it is essential that understanding the mechanisms behind violence and providing early, targeted intervention would benefit those males and our wider society.

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Appendix 1

Table 4. Multiple regression analyses examining predictors of violent offending including age, housing, qualifications, employment, ethnicity, and having a family history of mental illness

Variables	Coefficient	Chi square	Odds Ratio
Age	-0.05	28.0***	0.95
Housing	-	11.3**	-
Fixed abode	0.00	-	1.00
Temporary accommodation	0.30	7.12**	1.35
Homeless	0.14	0.47	1.15
Other	-0.45	2.98	0.64
Qualification	-	9.77	-
None	0.00	-	1.00
GCSE	-0.13	0.27	0.88
Vocational or NVQ	-0.05	0.10	0.95
A Level or Diploma	0.07	0.30	1.08
Degree	0.16	1.81	1.18
Other	-0.65	4.77	0.53
Employment	-	1.18	-
Paid/self-employed	0.00	-	1.00
Student	0.05	0.23	1.05
Other	0.19	1.77	1.20
Unemployed	0.10	0.15	1.11
Ethnicity	-	7.45	-
White British	0.00	-	1.00
White Other	-0.26	1.78	0.77
Black British	-0.22	2.45	0.80
Black African	-0.09	0.28	0.92
Black Caribbean	0.02	0.02	1.02
Mixed	-0.06	0.12	0.94
Other	-0.33	4.09	0.72
Family history of mental illness	-	5.56	-
Yes	0.00	-	1.00
No	0.15	1.82	1.16
Not sure	-1.98	3.60	0.14
Constant	0.35	-	-

Appendix 2

Table 5. Multiple regression analyses examining predictors of violent offending including age, housing, witnessing domestic violence, having lived in a children's home as a child, childhood history of being seriously injured due to violence by another person, being bullied as a child, and being seriously injured due to oneself as a child

Variables	Coefficient	Chi square	Odds Ratio
Age	-0.06	37.8***	0.95
Housing	-	11.2**	-
Fixed abode	0.00	-	1.00
Temporary accommodation	0.27	6.05**	1.31
Homeless	0.16	0.63	1.17
Other	-0.50	3.78	0.61
Witnessing domestic violence	0.20	4.48*	1.22
Having lived in a children's home	0.16	1.98	1.17
Serious injury due to violence by another person	0.22	3.65	1.25
Being bullied	0.08	0.58	1.09
Serious injury due to oneself	1.44	2.66	4.20
Constant	0.32	-	-

Appendix 3

Table 6. Multiple regression analyses examining predictors of violent offending including age, housing, prodromal questionnaire screening outcome, and history of ever attempting suicide

Variables	Coefficient	Chi square	Odds Ratio
Age	-0.06	42.4***	0.94
Housing	-	9.26**	-
Fixed abode	0.00	-	1.00
Temporary accommodation	0.24	4.93*	1.27
Homeless	0.05	0.73	1.06
Other	-0.48	3.43	0.62
Prodromal questionnaire screening	-	3.57	-
Negative	0.00	-	1.00
Positive	0.20	3.51	1.22
Psychotic	-0.05	0.01	0.95
Ever attempted suicide	0.31	4.31*	1.36
Constant	0.48	-	-

Appendix 4

Table 7. Multiple regression analyses examining predictors of violent offending including age, housing, daily alcohol use, monthly stimulant use, monthly weed use, and monthly opiate use

Variables	Coefficient	Chi square	Odds Ratio
Age	-0.05	34.6***	0.95
Housing	-	12.9	-
Fixed abode	0.00	-	1.00
Temporary accommodation	0.31	8.07**	1.37
Homeless	0.11	0.31	1.12
Other	-0.49	3.59*	0.62
Typical drinks per day:	-	16.4**	-
None	0.00	-	1.00
1-2	0.02	0.01	1.02
3-4	-0.07	0.29	0.93
5-6	-0.14	0.79	0.87
7-9	0.14	0.51	1.15
10+	0.42	9.13**	1.52
Monthly use of stimulants	0.25	8.56**	1.28
Monthly use of opioids	-0.11	3.56*	0.90
Monthly use of weed	0.04	1.55	1.04
Constant	0.03	-	-